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Construction Methods and Equipment

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April 1937

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In This Issue:

Sports Arena With
Thin-Shell Concrete Barrel Roof
Of 232-Ft. Span

Labor and Material Costs
On Six Road and Bridge Contracts

Steel Erector's Crane
Of 50-ton Capacity
With 144-Ft. Boom

Diesel Engines
For Construction Service
By R. L. Hambleton

Slide Blocked by Frozen Earth
At Grand Coulee Dam

Glass Block for Walls of
Industrial Building

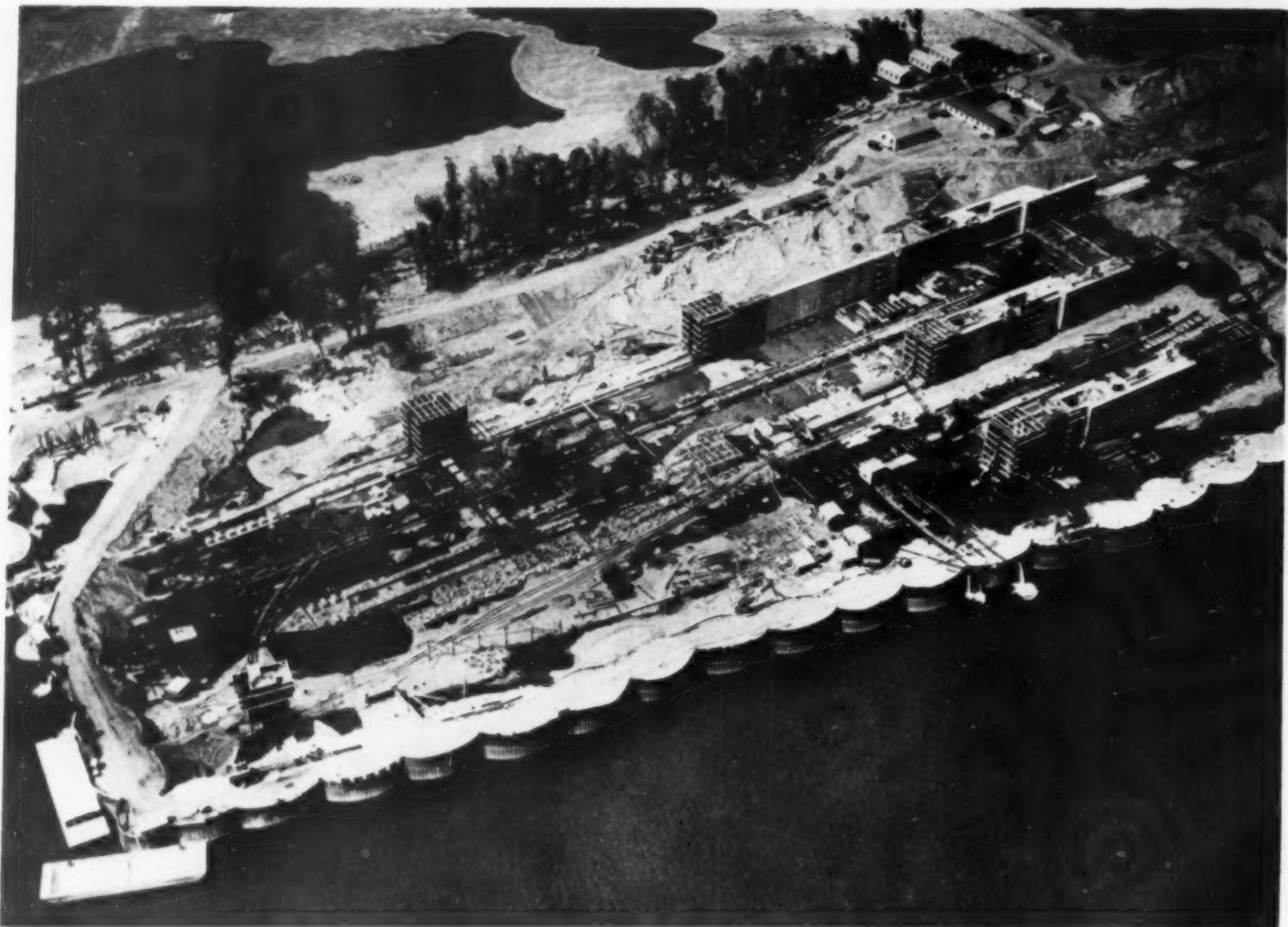
Heavy Construction (Part 16)
By A. J. Ackerman and C. H. Locher

Grouting Voids Under
Pavement Patches

Construction Equipment News
(Illustrated)



THIN-SHELL CONCRETE BARREL ROOF covering
great sports arena at Hershey, Pa., is reinforced near
lower edges with diagonal steel to resist tension



Inland Piling at Lock 25 On The Mississippi

Above: Construction photo of Mississippi Lock No. 25 at Cap Au Gris, Missouri. 2751 tons of Inland Section I-23 was used, some of the piles being 65 feet long.

This is the latest aerial photograph of the construction work underway on Lock No. 25 at Cap Au Gris on the Mississippi River.

The view clearly shows the neat tight job of Inland Steel Sheet Piling installed by the United Construction Co. United reports everything going well and work progressing splendidly.

This is but one of many successful

Inland Piling jobs on the Mississippi. But Piling is only a part of the picture, for Inland Engineers work closely with the contractors from beginning to end, co-operating on design, method and construction until the job is completed.

We invite you to call an Inland Engineer on your next Piling or other construction job—for Inland Service will prove definitely helpful to you.

SHEETS • STRIP • TIN PLATE • BARS • PLATES • STRUCTURALS • PILING • BILLETS • RAILS • TRACK ACCESSORIES

INLAND STEEL CO.

General Offices: 38 South Dearborn Street, Chicago, Illinois

TECHNICAL DEPT.

April, 1937 — CONSTRUCTION Methods and Equipment

Construction Methods and Equipment

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APRIL, 1937

CURRENT JOBS

and Who's Doing Them

Buildings

Public—Low bidder for additional stories for Federal Office Building, in New York City, was **Millimet Construction Co.** of Union City, N. J., with a price of \$2,100,000. At Sacramento, Calif., **MacDonald & Kahn**, of San Francisco, are building Army Air Corps supply depot buildings to cost \$1,589,851. Hospital buildings at Ypsilanti, Mich., costing \$874,000 are under construction by **Permanent Construction Co.** of Chicago. On a \$839,000 U. S. Post Office and Court House in Peoria, Ill., **Lundoff-Bicknell Co.** of Chicago, are at work. Veterans' hospital buildings in Los Angeles, Calif., went to **R. E. McKee**, of that city, for \$822,500. In Brooklyn, N. Y., high school extensions are under way by **The D. M. W. Contracting Co.** of Brooklyn, under a \$779,000 contract. Low bidder for a grain elevator in Vancouver, B. C., was **Carter-Halk-Aldinger Co. Ltd.** of Toronto, with a tender of \$647,229. A high school in Appleton, Wis., went to **M. Schumacher**, of Minneapolis, Minn., for \$616,000. For a narcotic farm building in Fort Worth, Tex., **R. F. Ball Construction Co.** of that city, bid \$495,983.

Industrial—A \$7,000,000 steel mill project at Aliquippa, Pa., is being started, with its own forces, by **Jones & Laughlin Steel Corp.** of Pittsburgh, Pa. In Windsor, Ontario, **Allen Construction Co. Ltd.** of Windsor, are building a \$4,300,000 assembly plant for the Ford Motor Co., of Canada. For an Atlas Powder Co. factory structure in Wilmington, Del., to cost about \$2,500,000, the general contractor is **Stofflet & Tillessen**, of Philadelphia; for the steel work a subcontract went to **McCormick Construction Co.** of Wilmington. **Arthur G. McKee & Co.** of Cleveland, Ohio, is contractor for a \$2,500,000 blast furnace at Ecorse, Mich., for Great Lakes Steel Corp. of Cleveland. In Toledo, Ohio, **Lummus Co.** of Philadelphia, Pa., is building a \$2,000,000 refinery for the Pure Oil Co.; steel tanks for the project are being fabricated by **Chicago Bridge & Iron Works**. A bid of \$1,300,000 obtained for the **White Construction Co.** of New York, a milk bottling building contract from **Sheffield Farms Co.** The **Austin Co.** of Seattle, bid in for \$1,300,000, a pulp mill project in Everett, Wash., for the Sound View Pulp Co., of Everett. A steel mill at Campbell, Ohio, for Youngstown Sheet & Tube Co., is being built by **Aetna Standard Engineering Co.** of Youngstown, for \$1,000,000. With a bid of \$850,000, **James Stewart & Co.** of New York, obtained contract for a plant building at Kearny, N. J., from the Coca Cola Co. In Corpus Christi, Tex., an oil refinery for Barnsdall Oil Co., of Tulsa, Okla., is under construction by **Frick-Reid Co.** of Tulsa. General contract for a \$700,000 Armour & Co. packing plant building in Omaha, Neb., went to **V. Ray Gould Co.** of that city. **Alco Products Co.** of Dunkirk, N. Y., is building a \$500,000 refinery at Houston, Texas, for Shell Petroleum Co. A steel incinerator is being built in Cleveland, Ohio, by **John Gill & Sons Co.** of Cleveland, for \$328,318.

Commercial—Addition to museum, New York City, is under construction, at cost of \$1,000,000, by **Turner Construction Co.** of New York. **Shroder & Koppel**, of New York, are building a \$1,000,000 apartment at 150 Central Park South, New York, for Douglas L. Elliman & Co. In Montreal, Canada, a \$500,000 department store contract for Holt Ren-

rew Co. went to **Anglin Norcross Corp. Ltd.** of Montreal. **Consolidated Steel Corp.** is building sound stages and steel structures for Metro-Goldwyn-Mayer Studios at Culver City, Calif., to cost \$500,000. University of Chicago has given \$500,000 building contract to **W. J. Lynch Co.** of Chicago.

Bridges

The following are among bridge contracts recently awarded: Three contracts, aggregating \$1,450,000, for bridges and roads on the route of the Overseas Road & Toll District, in Florida, had as low bidders **S. J. Groves Construction Co.** of Minneapolis; **Clarke Bros. Construction Co.** of Clinton, Ia.; and **Thomas F. Kenney Construction Co.** of Orlando, Fla. In San Francisco, Cal., **Bates & Rogers Construction Co.** of that city is engaged on a \$684,803 contract for East Bay yard railway facilities in connection with the San Francisco-Oakland Bay bridge. A grade separation structure at Colonia, N. J., is being built by the **Centaur Construction Co.** of New York, for \$224,208. For the Thousand Islands bridge across the St. Lawrence River near Collins Landing, New York, low bidders on substructure and superstructure are: **Dominion Construction Co.** of Toronto, \$207,673; **Cameron & Phim**, of Welland, Ont., \$117,379; **R. A. Blyth**, of Toronto, \$29,963; **American Bridge Co.** of New York, \$759,817; **Canadian Bridge Co.** of Walkerville, Ont., \$896,628. In Maryland and Virginia a bridge across the Potomac River will be built by **G. F. Hazelwood**, of Cumberland, Md., for \$340,431. **J. C. O'Connor & Sons, Inc.** of Fort Wayne, Ind., have a \$195,943 bridge contract in Lake County.

Roads

In Mississippi 20.5 mi. of the Hattiesburg-Collins highway went to **Barber Bros. Construction Co.** of Baton Rouge, La., for \$428,829. Nevada awarded 17 mi. of road in Elko County to **Utah Construction Co.** of Ogden, Utah, for \$476,245, and 11.6 mi. near Las Vegas, to **O. Nelson**, of Ogden, Utah, for \$372,723. With a bid of \$404,215 **Hallett Construction Co.** of Crosby, Minn., was low on 16.6 mi. of road in Osceola County, Iowa. City widening and paving in Chicago, Ill., is being done under a \$274,696 contract by **Standard Paving Co.** of that city, and under a \$334,972 contract by **Anderson Co.** also of Chicago. For 3.65 mi. of bituminous highway near Washington, Pa., **N. L. Teer**, of Durham, N. C., was low with \$313,293. Missouri concrete paving and bridge contracts were bid in by **M. E. Gillioz**, of Monett, Mo., for \$292,158 and \$335,654, respectively. **Skousen Bros.**, of Albuquerque, N. M., obtained a \$239,766 contract for 31.9 mi. of asphaltic surfacing in Coconino County, Arizona.

Waterworks

Start of construction on New York City's additional water supply from the Delaware River was signalized by the award of contracts for shaft-sinking for aqueduct tunnels, to **Frazier-Davis Construction Co.** of St. Louis, Mo., for \$2,294,415 and to **W. E. Callahan Construction Co.** of Dallas, Texas, for \$1,926,150. A \$1,426,000 water main contract in Toronto, Canada, went to **Atlas Construction Co.** of Montreal, for \$1,426,000. **Basich Bros.**, of Los Angeles,

The "How" of it

For the benefit of readers concerned with the practical application of method or equipment.

the following references are to articles or illustrations in this issue that tell:

- How **ADJUSTABLE TRIPOD FRAME** of truck-mounted pipe driver simplified spotting of hammer. — p. 41
- How **MOBILE TIMBER SCAFFOLD** supported forms for barrel arch roof of 232-ft. span. — p. 44
- How **SCREW JACKS** on timber scaffold towers raised and lowered roof forms. — p. 46
- How **TAUT METAL WIRES** reeved through pulleys from underside of forms to central information board aided control of jacking. — p. 47
- How **RECORDS OF SIX HIGHWAY JOBS** offered opportunity to compare man-hours of labor per \$1,000 contract cost. — p. 48
- How **HINGED JIBS** on steel erector's crane permitted combined vertical and horizontal reach. — p. 52
- How **MOVING BOOM HITCHES** to rear of crane gave greater angle for high boom while retaining gantry support for low boom. — p. 52
- How **SANDBAGGED BULKHEADS** raised crests of levees against menace of flood waters. — p. 53
- How **CLEAN DIESEL FUEL** has reduced wear in injection equipment of diesel engines. — p. 54
- How **STUCK RINGS** in diesel engines have been prevented by use of lubricating oil of superior quality. — p. 55
- How **TWO ICE MACHINES** froze earth dam to stop huge slide into excavation area. — p. 56
- How **TERRACED GREENHOUSE** of setback solid roof construction has averted glass breakage by hailstones. — p. 57
- How **HUGE BALLOON TIRES** have made possible an amphibian vehicle for use in swamps. — p. 57
- How **MOVABLE FLOATING SPAN** in temporary construction treated permitted river traffic to pass. — p. 58
- How **"GRASSHOPPER"** device lined up pipe lengths for tack welding joints in field. — p. 58
- How **SMALL CLAMSHELL RIG** utilized available air power to operate bucket. — p. 59
- How **OIL BURNER** under metal wheelbarrow heated rock asphalt for pavement patching. — p. 59
- How **GLASS BLOCKS** were laid up in masonry walls by brick masons using cement mortar. — p. 60
- How **DRAINAGE SYSTEM** of gravel fill between walls of creosoted wood sheeting intercepted groundwater. — p. 61
- How **WEIGHT OF LOCOMOTIVE** for required drawbar pull has been reduced to formula. — p. 63
- How **ROPE TRAMWAYS** transported gravel over rough country on large dam projects. — p. 66
- How **BELT CONVEYOR SYSTEM** moved more than 10,000,000 cu.yd. of spoil on one dam project. — p. 66
- How **HYDRAULIC PUMPING** from hog boxes produced desired separation of materials in earth dams. — p. 67
- How **PORTABLE MOUNTING** for grout machine facilitated its use in filling voids under pavement. — p. 68

ROBERT K. TOMLIN

Editor

WILLARD CHEVALIER

Vice-President

Editorial Staff: Vincent B. Smith, John B. Hutton (San Francisco), Paul Wooton (Washington), Nelle Fitzgerald

were awarded a \$205,004 contract for cast-in-place concrete pipe for feeder system of Colorado River aqueduct, in California.

Subways

Work is progressing on the construction of the Sixth Ave. subway, New York City, under five contracts, aggregating \$29,144,000 as follows: 18th-27th Sts., **Arthur A. Johnson Corp.-Necarco Co. Inc.**, \$4,715,863; 27-33rd Sts., **Carle-**

ton Co. Inc., \$6,392,879; 33rd-40th Sts., **Park Contracting Corp.**, \$7,834,606; 40th-47th Sts., **Rosoff-Brader Construction Co.**, \$5,583,768; 47th-53rd Sts., **George H. Flinn Corp.**, \$4,616,476.

Sewers

A sewer and sewage disposal plant contract at Detroit, Mich., was awarded to **S. A. Healy Construction Co.** of Detroit, for \$1,610,214.

A New Attack on HIGHWAY NEGLECT

FROM Washington comes the heartening news that a federal drive is on against the continued diversion of state highway revenues to other than highway purposes.

The Hayden-Cartwright Act of June 18, 1934, made it very clear that the federal government did not intend to make good indefinitely the wanton misuse by the states of their own highway revenues; and it prescribed the penalties that might be suffered by those states that should fail to put their houses in order.

In some quarters these provisions of the Act have not been taken too seriously; at all events, some of the states have gone blithely ahead with their diversion, apparently confident that somehow they would contrive to evade the penalties.

NOW the Bureau of Public Roads serves notice on Maryland that, because of its diversion, it must suffer the loss of \$341,677, this being one-third of its share of the Federal Aid funds apportioned for the fiscal year ending June 30, 1937, "unless it can make an immediate showing satisfactory to the Bureau why such deduction should not be made."

It appears that for some time the Bureau has been investigating the misuse of highway revenues in each of the states; several more, we are told, are listed as being liable to similar penalties under the statute.

It is noteworthy that just a day or two before the Bureau of Public Roads published its announcement, the annual report of Colonel Frederick Stuart Greene, New York State Superintendent of Public Works, warned the Legislature that the highway system of the state now is far from adequate.

When we remember that, of all the states, New York has been for several years the most reckless in raiding its highway revenues for other purposes, the following statement by Colonel Greene is eloquent testimony to the results of that policy:

"The system," he reports, "is now not only trailing present-day requirements, but has not kept step with the advances made by our sister states."

"This falling behind in highway construction has been especially noticeable during the past three years."

It is during "the past three years" that the state administration has been warned repeatedly by students of its highway policies as to what would be the ultimate effect of misusing its highway funds; this official report by the man responsible for its Public Works Department is but notice that the state and its citizens now are paying the price of its neglect.

With this evidence as to the unfortunate results of an aggravated case of gas-tax diversion and with the federal government now putting teeth into the penalty clauses of the Hayden-Cartwright Act, those who are fighting, throughout the country, for sound highway policies should take new heart. The time is here for them to redouble their efforts.

IN MANY STATES diversion either still persists or looms as a threat. A few states have averted such threats by suitable amendments to their constitutions. In every state that now practices diversion of highway revenues these developments should suggest ample reason for its discontinuance; in states now free from the diversion abuse, they should be convincing reason for not invoking it. In every state the matter of constitutional amendment as a continuing insurance against future lapses deserves earnest study and effort.

Sooner or later the exploitation of the highway user and the neglect of the highways will recoil on the state that practices them. In the long run the misuse of the funds required to keep highway improvement abreast of the need must cost the people double: they must pay increased motor operating costs, risk increasing traffic hazards and suffer the depreciation of the investment they already have in their highways. And when their state incurs the penalties of the Hayden-Cartwright Act they are nickel'd further for the loss of their normal share of Federal Aid funds.

The federal government has said, fairly enough: divert your gas-tax money and we will divert your Federal Aid. But, after all, it is the highways that we want, not the penalties. And it is to be hoped that all of the states now will take steps to end the diversion abuse as quickly as possible.

Willard Chevalier

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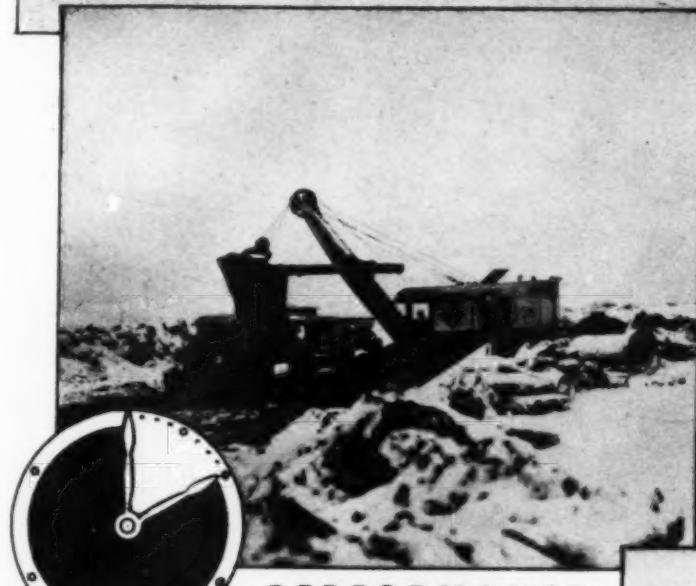
NOT AN ESTIMATE BUT A RECORD!

ON THE
NEW YORK WORLD'S FAIR SITE

By Johnson-Necaro Co. with

20 Bottom Dump TRAC-TRUKS

Length of working day, available hours - - -	22.5
Number of available days in period - - -	151
Total available Trac-Truk hours during period - - -	67,930
Total pay yards hauled by the fleet - - -	3,200,000 yards
Yards hauled per available Trac-Truk hours, overall job average - - -	47 yards



PERFORMANCE
THAT PROVES
TRAC-TRUKS
EXCEL ON CYCLE-TIME PRODUCTION

COMPLETION date loomed large at the inception of this major excavation project . . . with seven months allotted and winter weather intervening. Literally acres of ashes and miscellaneous accumulation of rubbish . . . not easy material to handle speedily . . . had to be loaded, moved and placed over Long Island's oozing lowlands offering little in firm haul roads. For this exacting work the contractor selected *Trac-Truks* based upon a previous experience with them. This score of units did their part in the very creditable showing summarized above. Here again Trac-Truk capacity in pay loads . . . travel speed and all 'round ability to perform under adverse conditions, registered high average results in the actual production and cost figures.



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You will get at least 3 to 4 times longer service, when, instead of ordinary grease for chassis lubrication, you use Texaco MARFAK.



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New Texaco is purified by the Furfural Process. Furfural is a farm product made from oats, corn, wheat, cotton seed, sugar cane, etc. In refining, this furfural dis-

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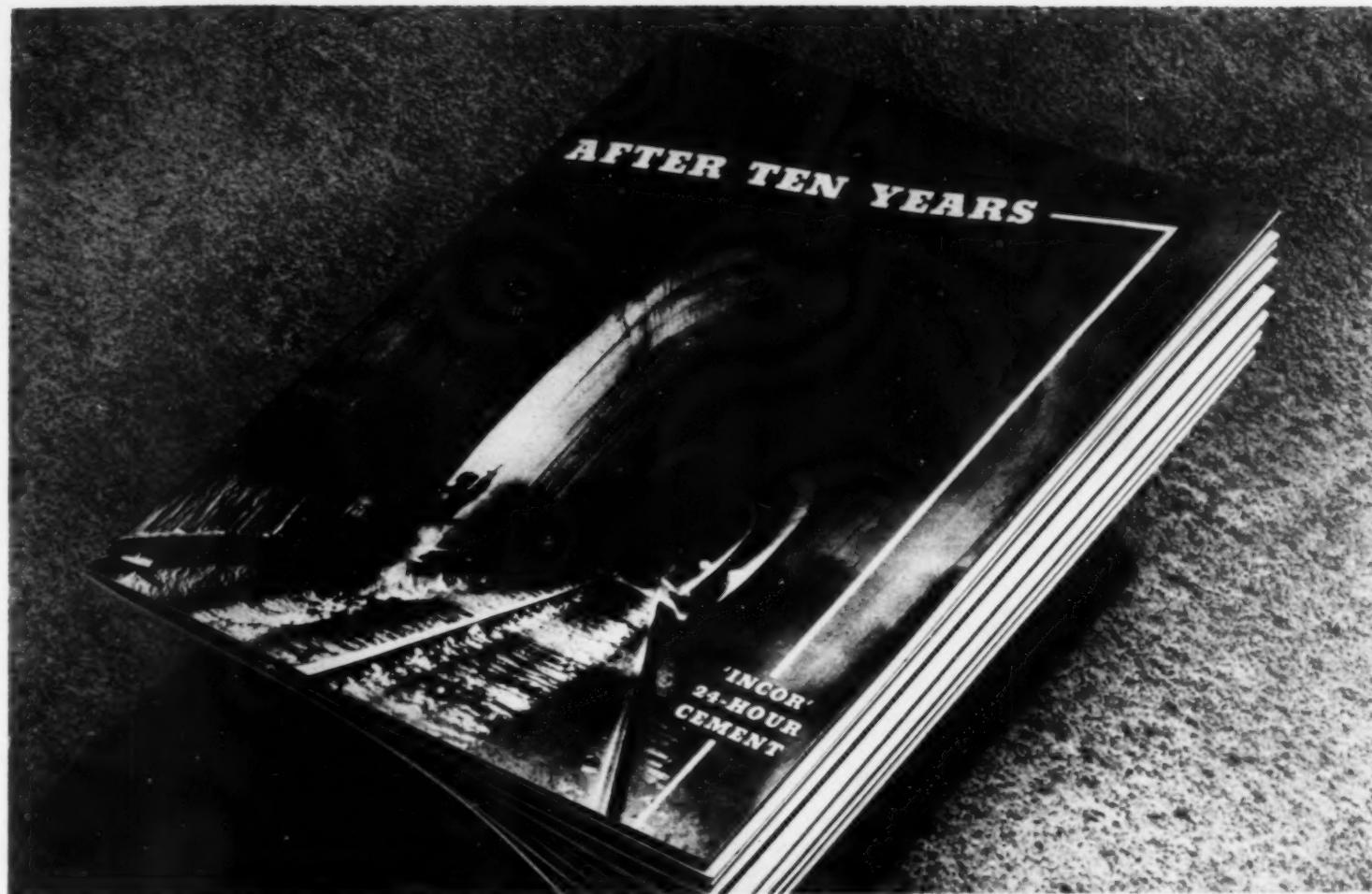


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Industrial Lubricants

April, 1937 — CONSTRUCTION Methods and Equipment



THE FIRST 10 YEARS ARE THE HARDEST

A DECADE ago, high early strength Portland cement was an unknown quantity. Yes, you could use the concrete 24 hours after it was placed. But what about strength and durability? It is just ten years since the makers of Lone Star Cement introduced 'Incor'—the true Portland cement, which cures or hardens thoroughly in 24 hours, of itself and by itself, without admixtures or accelerators—simply because the property of high early strength is built into the cement itself.

Today the ultimate strength and durability of 'Incor' concrete have been proven by a decade of use. Many miles of concrete paving and hundreds of concrete structures attest the fact that 'Incor' not only saves money at the outset, by eliminating non-productive time waiting for concrete to

harden—but, in addition, provides greater long-time strength, durability and wear-resistance.

The ten-year record of 'Incor' surprises no one who is familiar with the care and skill with which the product is made. For ultimate strength and durability are also built into the cement at the mill, as laboratory tests clearly proved before a single barrel of 'Incor' was ever shipped.

In a word, the ten-year record clearly shows that 'Incor'* is producing the same kind of high quality concrete that engineers and contractors have been getting with Lone Star Cement ever since 1900. Write for details in new book, "After Ten Years." Address Lone Star Cement Corporation, Room 2213, 342 Madison Ave., New York. * Reg. U. S. Pat. Off.

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CONSTRUCTION Methods and Equipment — April, 1937

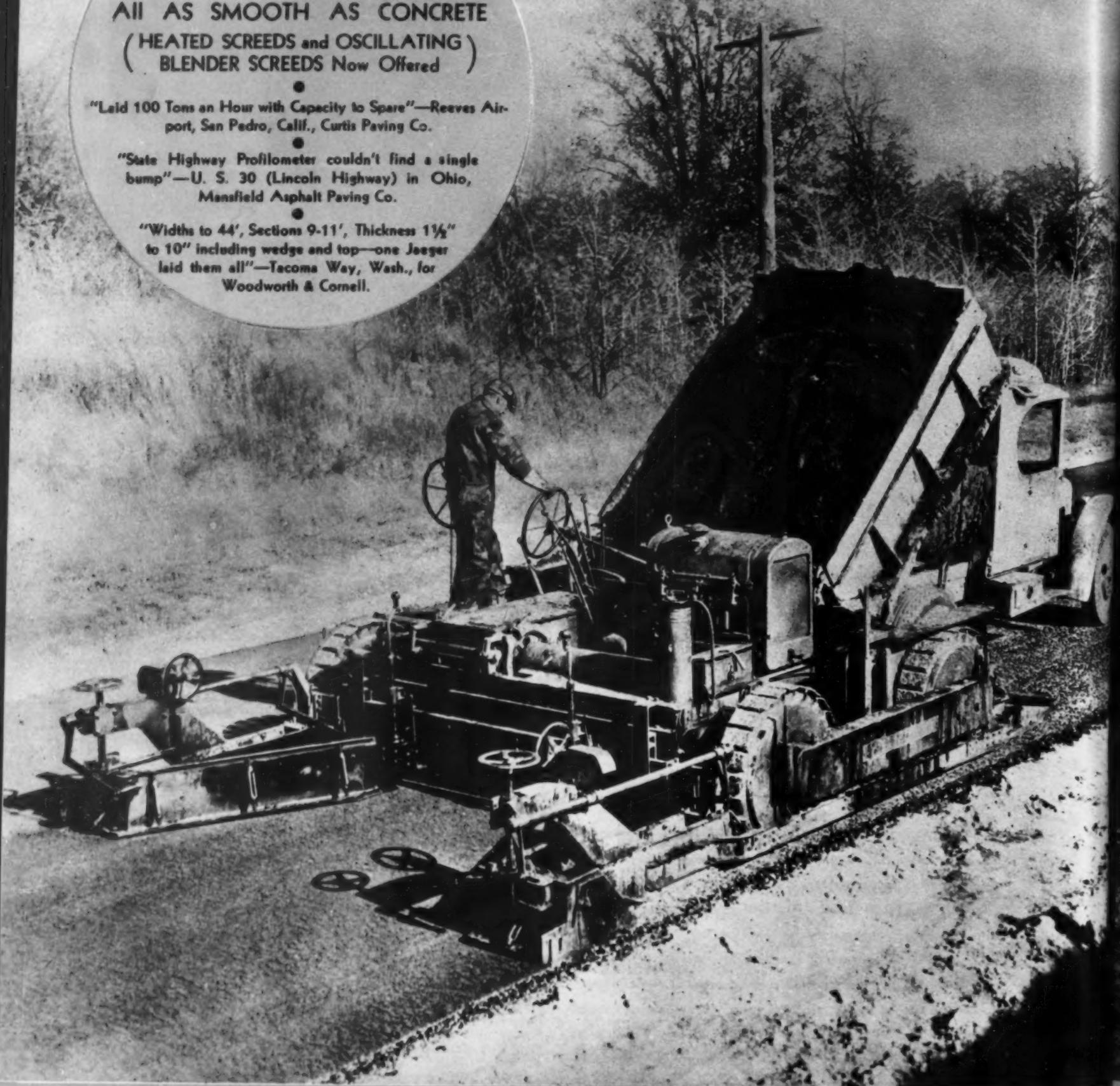
Page 7

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 DAILY — Widths to 14 Ft.,
 Hairpin Turns, Steep Grades, Curve
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ALL AS SMOOTH AS CONCRETE
 (HEATED SCREEDS and OSCILLATING)
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 laid them all"—Tacoma Way, Wash., for
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JAEGER BITUMINOUS PAVER

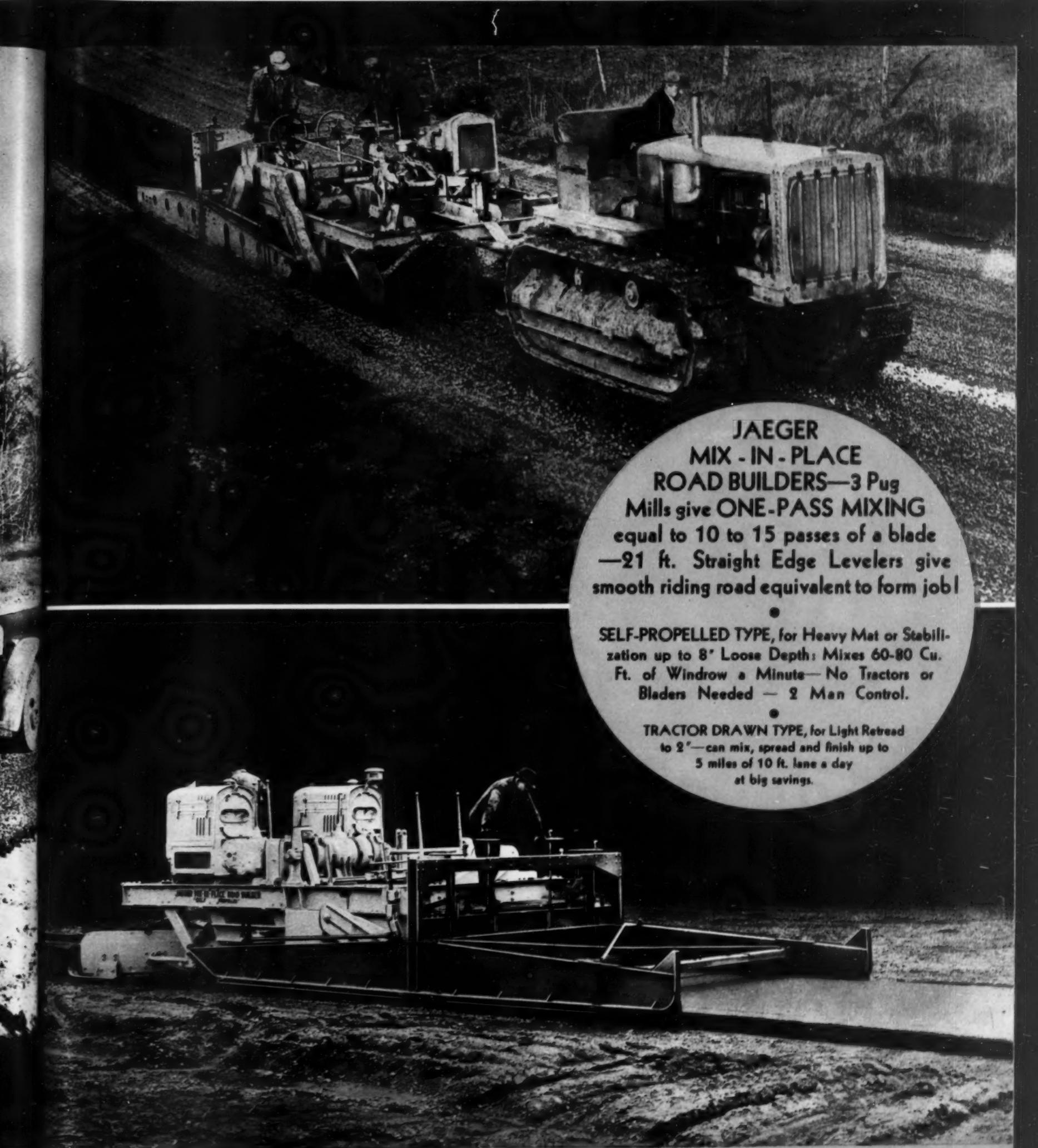
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 BUILT-IN WIDTH ADJUSTABILITY

LAYS ALL TYPES HOT OR COLD BITUMINOUS

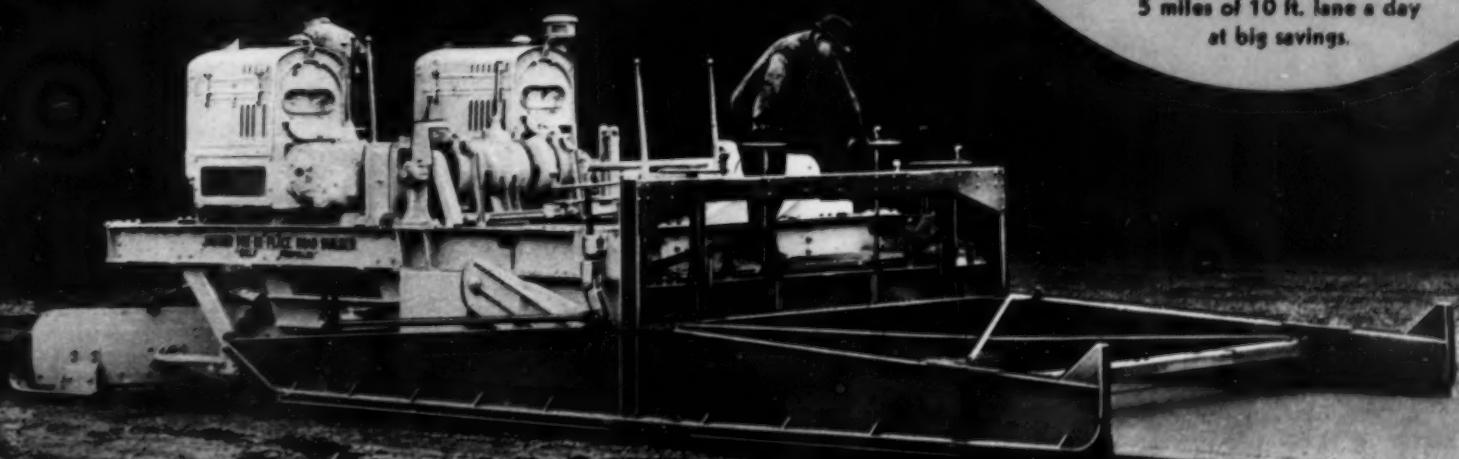




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SELF-PROPELLED TYPE, for Heavy Mat or Stabilization up to 8' Loose Depth: Mixes 60-80 Cu. Ft. of Windrow a Minute—No Tractors or Bladers Needed — 2 Men Control.

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TRACTOR DRAWN TYPE, for Light Retread to 2"—can mix, spread and finish up to 5 miles of 10 ft. lane a day at big savings.



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MINES

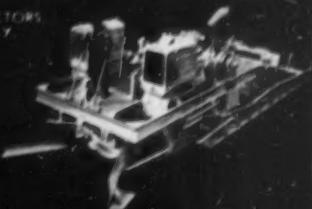
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ONE PASS MIXING PERMITS QUICK CURING
BITAKERS. READY FOR TRAFFIC WHEN
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OVER 370 MILES
BITAKED RETREAD BUILT
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NEARLY 50 MILES
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DEPT. OPERATES 5 JAEGERS

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ONE PASS MIXING
SAVE 50% ON EQUIPMENT. NO TRACTORS
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World's Most Valuable Pavements—Golden Gate, San Francisco—Oakland Bay, and George Washington Bridges—Total 10.8 miles of Pavement Worth \$165,000,000 . . . Jaeger Finishers Paved Them All!

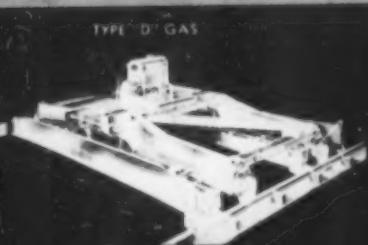
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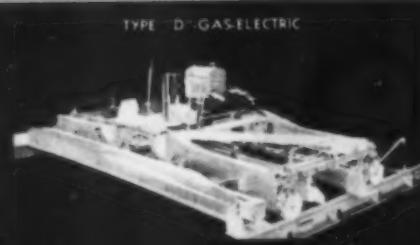
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1-1 1/2-3-4-5 CU. YARD SIZES



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HIGH REAR LEFT-ADDS 25% MORE
SPOUTING AREA

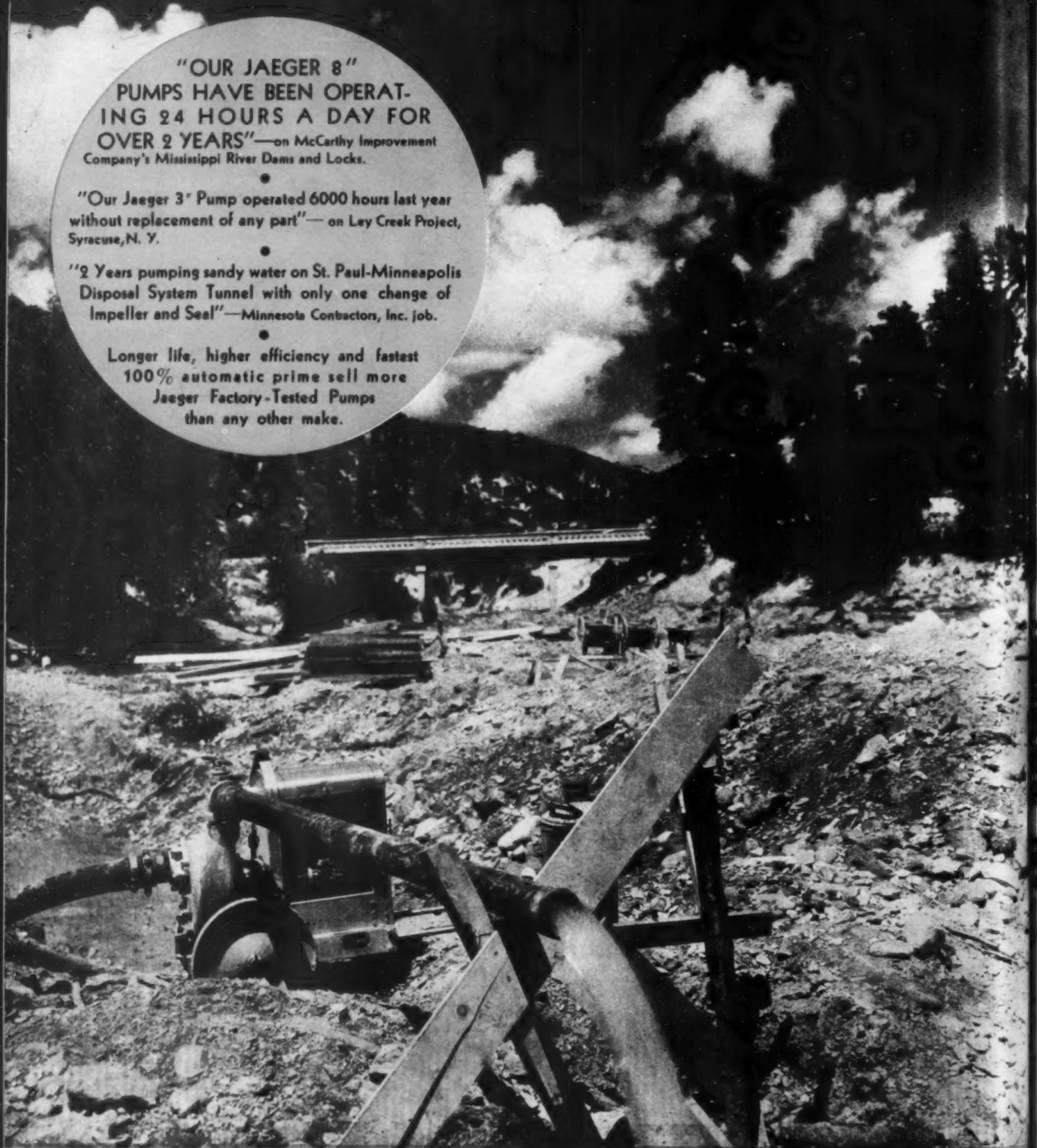


"OUR JAEGER 8"
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OVER 2 YEARS"—on McCarthy Improvement
Company's Mississippi River Dams and Locks.

"Our Jaeger 3" Pump operated 6000 hours last year
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"2 Years pumping sandy water on St. Paul-Minneapolis
Disposal System Tunnel with only one change of
Impeller and Seal"—Minnesota Contractors, Inc. job.

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100,000 G.P.H.

WELL POINT SYSTEMS

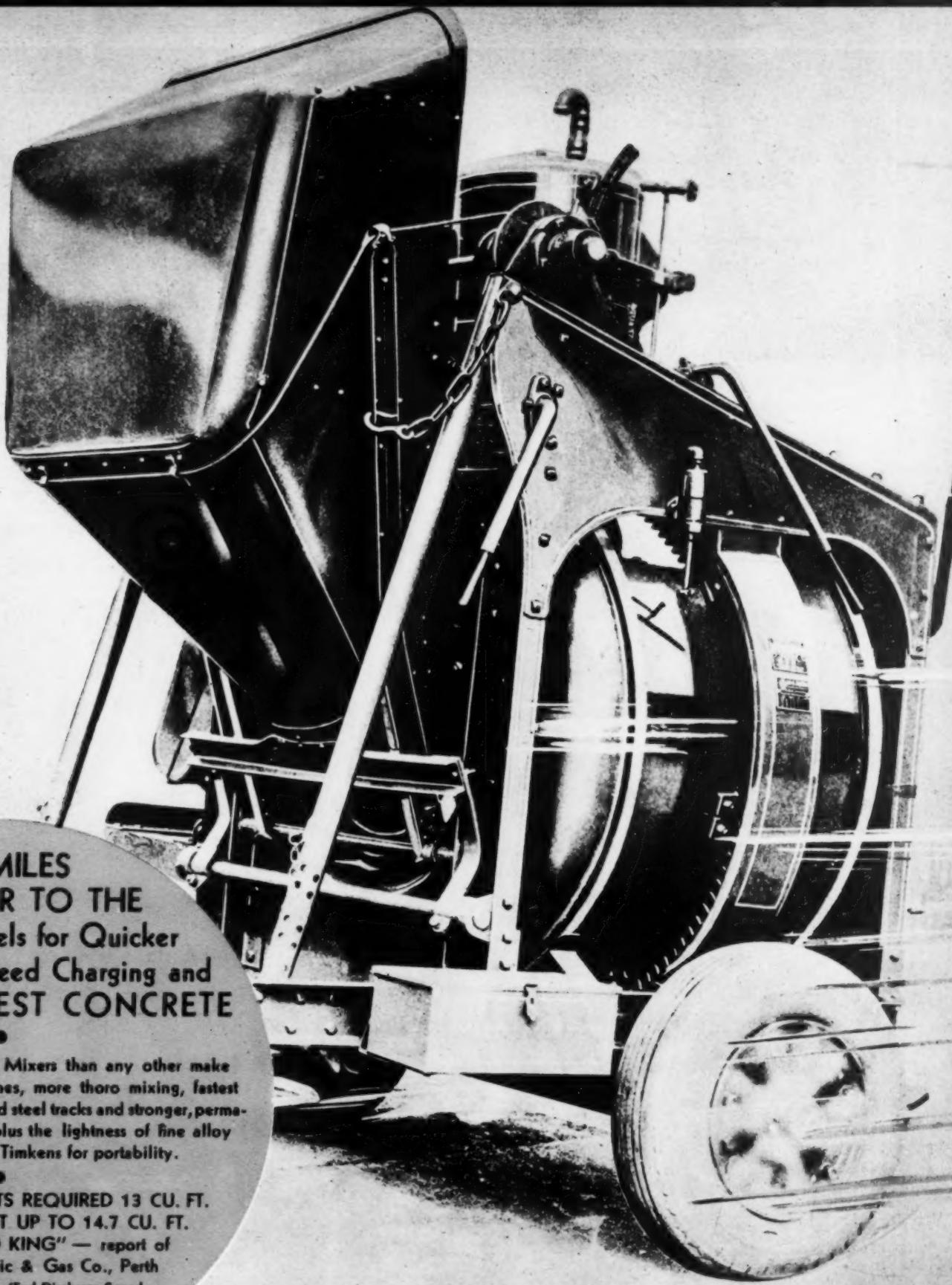


SELF-PRIMING
8-STAGE
CENTRIFUGAL
JETTING PUMPS



TRIPLEX ROAD PUMPS
—OVER 1500 D.P.S.
—NOT A SINGLE
FAILURE





**35 MILES
PER HOUR TO THE
JOB, 2 Wheels for Quicker
Spotting, Top Speed Charging and
Discharge of DRIEST CONCRETE**

Contractors buy more Jaeger Mixers than any other make because they get bigger engines, more thorough mixing, fastest charging and discharge, machined steel tracks and stronger, permanently aligned main frames—plus the lightness of fine alloy steel on pneumatic tires and Timkens for portability.

"PREDETERMINED COSTS REQUIRED 13 CU. FT.
BATCHES—THEY GOT UP TO 14.7 CU. FT.
WITH A 10S SPEED KING" — report of
Public Service Electric & Gas Co., Perth
Amboy, N. J. job. (End Discharge Speed
King, here shown, built in 75 and
105 sizes)

CHINE
OHIO
SEND FOR LATEST COMPLETE CATALOG, PRICES
THE JAEGER MACHINE CO., COLUMBUS, OHIO

JAEGER HIGH SPEED MIXERS



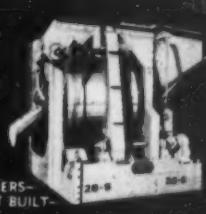
POWER LOADER TILTERS—
55, 75, 105 SIZES



STANDARD 4-WHEEL NON-TILT MIXERS—
75, 105, 145 SIZES



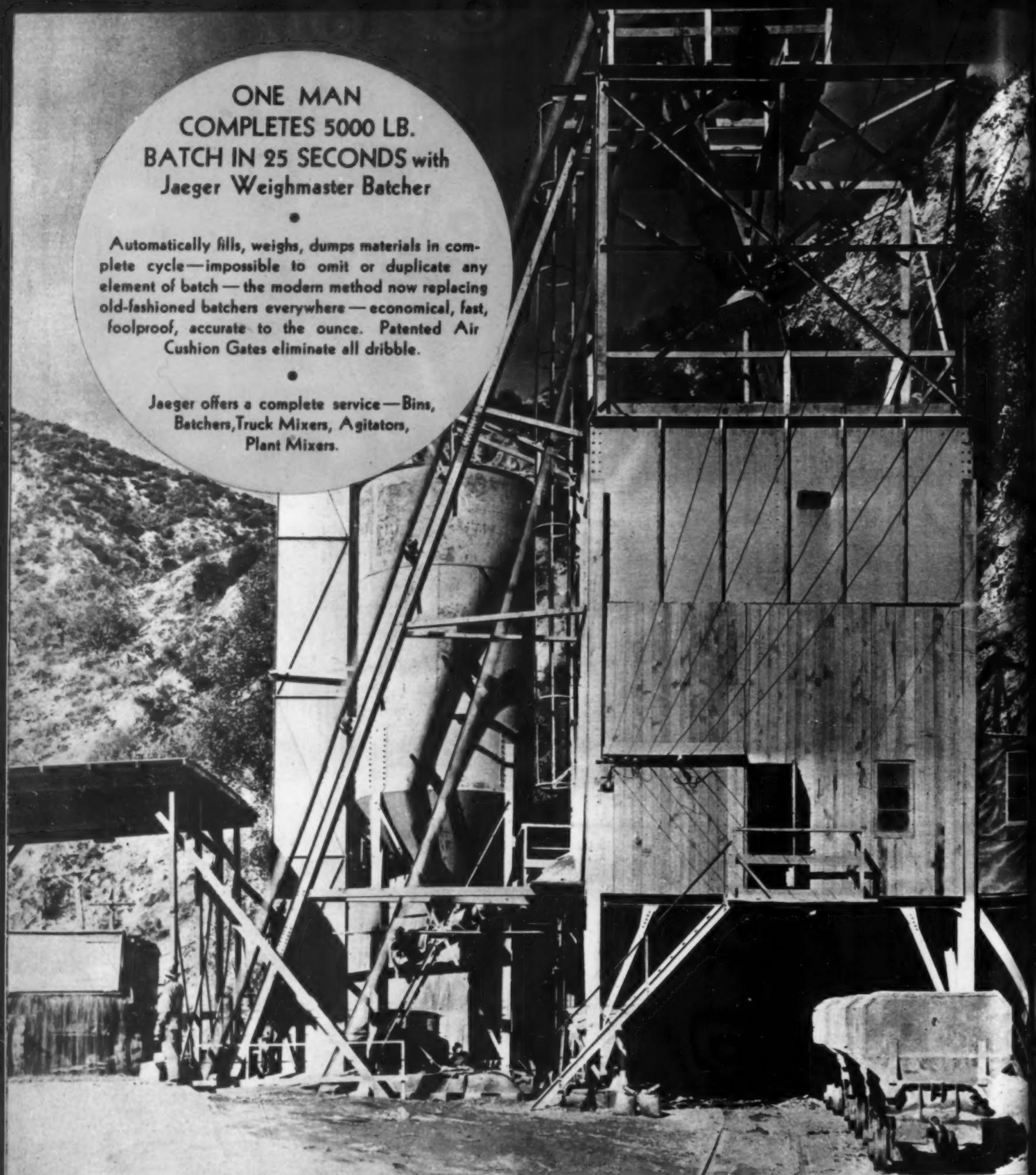
LATEST TYPE PLANT MIXERS—
FASTEST, MOST COMPACT BUILT—
885, 565



ONE MAN
COMPLETES 5000 LB.
BATCH IN 25 SECONDS with
Jaeger Weighmaster Batcher

Automatically fills, weighs, dumps materials in complete cycle—impossible to omit or duplicate any element of batch—the modern method now replacing old-fashioned batchers everywhere—economical, fast, foolproof, accurate to the ounce. Patented Air Cushion Gates eliminate all dribble.

Jaeger offers a complete service—Bins,
Batchers, Truck Mixers, Agitators,
Plant Mixers.



JAEGER BINS AND BATCHERS



AGGREGATE BATCHERS
FULL AUTOMATIC OR
MANUAL CONTROL—ALL SIZES

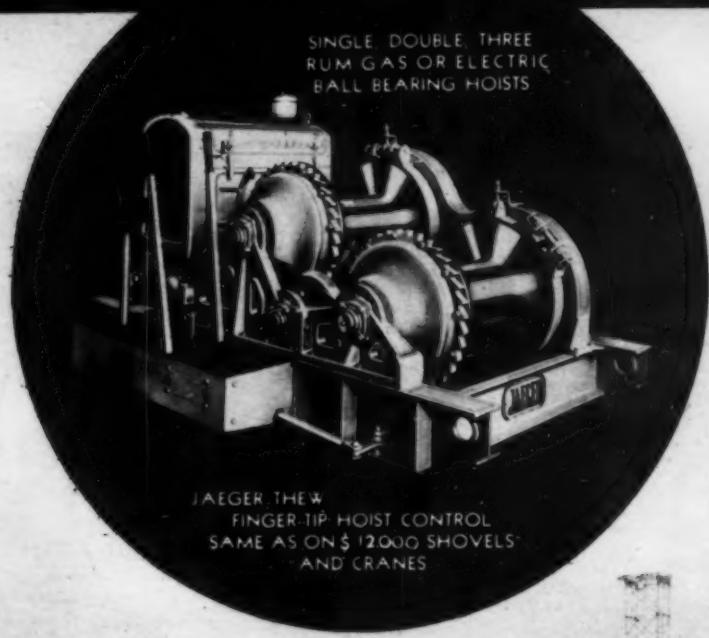


CEMENT BATCHERS
CONVEYORS—NEW
SAVINGS IN USING BULK
CEMENT



THE JAEGER MACHINE CO.
COLUMBUS, OHIO, U.S.A.

JAEGER TIPPLE TANKS
FAST, ABSOLUTELY ACCURATE



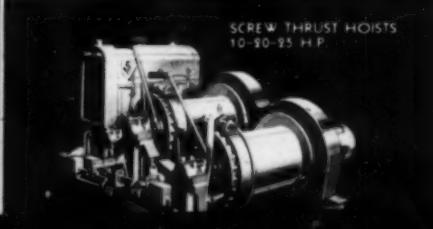
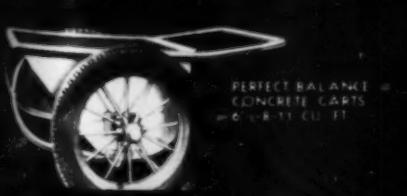
4 LBS. PRESSURE,
ON JAEGER GIANT
EXPANDING FRICTIONS, LIFTS
HUGE LOADS (Versus 70 Lbs. on
Old Type "V" Cone Hoists)

Jaeger Ball Bearing Hoists to 100 H. P. size, Jaeger-Lakewood Towers, Mast Plants, Bucket and Chuting, offer most complete modern line for efficient handling and placing of material and concrete.

From big skyscrapers and dams to small schools, apartments, grade separations, Jaeger-Lakewood Equipment meets the condition. Complete layouts and estimates furnished on request. Send details.

INE CO.
U. S. A.
ND FOR LATEST COMPLETE CATALOG, PRICES
JAEGER MACHINE CO., COLUMBUS, OHIO

JAEGER HOISTS — TOWERS



LA PLANT-CHOATE SHEEP-FOOT TAMPING ROLLERS



DON'T WAIT FOR FILLS TO SETTLE!

LaPlant-Choate Sheep-

Foot Tamping Rollers are available in Single Drum, Double Drum, or Triple Drum models. Contractors need no longer wait for fills to settle. These Tamping Rollers do the work quickly and thoroughly. In the Double and Triple Drum models, each drum is an independent oscillating unit so as to permit

quick adaptation to uneven surfaces. Feet are designed to facilitate maximum pressure yet their special design eliminates suction. A positive self-cleaning device keeps the feet from becoming packed with dirt. The drums are hollow and water-tight with a removable plug to permit filling with water for ballast in increasing ground pressure or to empty same for shipping.

FOR
FULL DETAILS
CALL YOUR
CATERPILLAR
DEALER
OR
WRITE TO
LA PLANT-CHOATE
MANUFACTURING CO.
CEDAR RAPIDS,
IOWA

SCRAPERS • SNOW PLOWS • BULLDOZERS • ROAD BUILDERS • BRUSH CUTTERS • RUBBER WHEELED WAGONS

LaPlant-Choate Mfg. Co. Inc.
CEDAR RAPIDS, IOWA



The Leschen Quality Crew

A winning boat crew must have strength, rhythm, and endurance. If even one member shirks or is out of time—the race is lost.

And it is the same with wire rope. To be successful it must have certain vital qualities—and all must work in proper harmony and balance.

The "Quality Crew" that makes "HERCULES" (Red-Strand) Wire Rope a *consistent* winner, is composed of Elasticity, Flexibility, Toughness, Durability and Strength. Our rigid wire tests, our proven standards and methods, and our 80 years of manufacturing experience—insure the proper training, or balancing, of this crew.

And the performance record of this wire rope continues to make and hold friends.



Round Strand

Flattened Strand

Preformed

Steel Clad

Non-Rotating

•

Made Only By

A. Leschen & Sons Rope Co.

ESTABLISHED 1857

5909 Kennerly Avenue, St. Louis, Mo.

New York.....90 West Street
Chicago.....810 W. Washington Blvd.
Denver.....1554 Wazee Street

San Francisco.....520 Fourth Street
Portland.....914 N. W. 14th Avenue
Seattle.....2244 First Avenue South

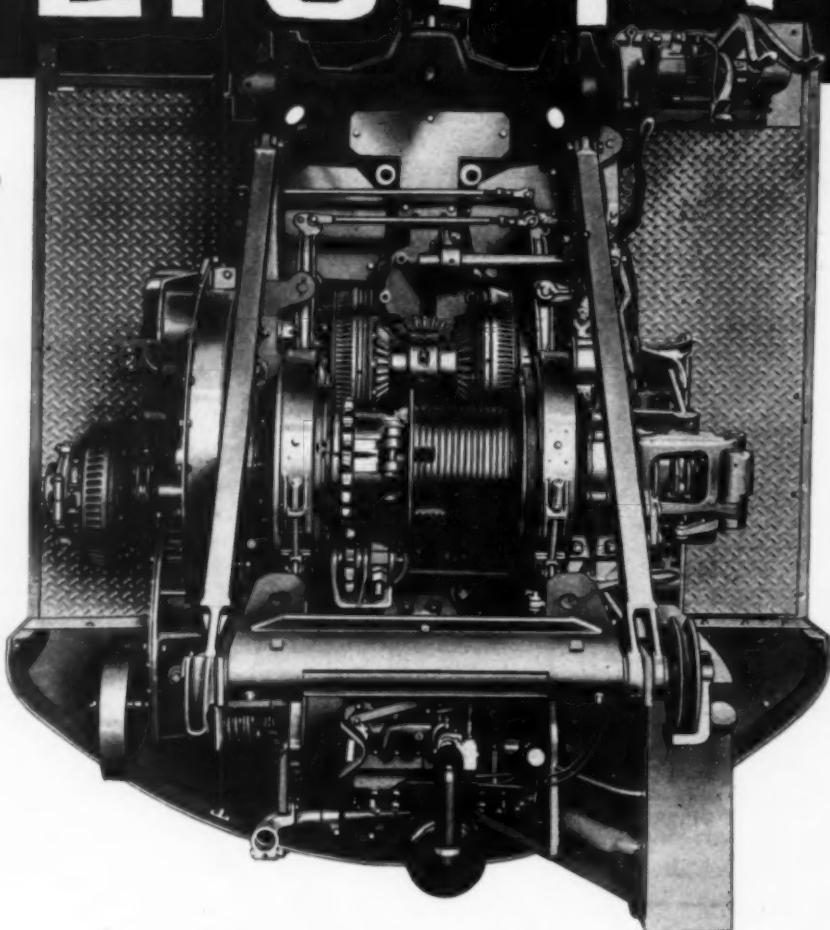
SIMPLICITY

*Counts in a
small shovel
too!*

SIMPLICITY has always been a keynote in Northwest design—simplicity with the proper placing of mechanism back of the center pin, to assure stability without excess counterweight.

This is true of Northwest $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{3}{4}$ yd. shovels, cranes and draglines just as in the larger units.

Northwest simplicity in Northwest small machines assures their being easily maintained, easily understood, easily operated. You have a power plant, a trouble-free helical gear drive, and assembles on two main shafts—that's all.



NORTHWEST ENGINEERING CO.

*The world's largest exclusive builders of gasoline, oil,
diesel or electric powered shovels, cranes, draglines,
pulldozers and skimmers*

1728 Steger Building
28 E. Jackson Boulevard
Chicago Illinois



NORTHWEST

SHOVEL . . .
CRANE . . .
DRAGLINE . . .
TRUCK SHOVEL
TRUCK CRANE

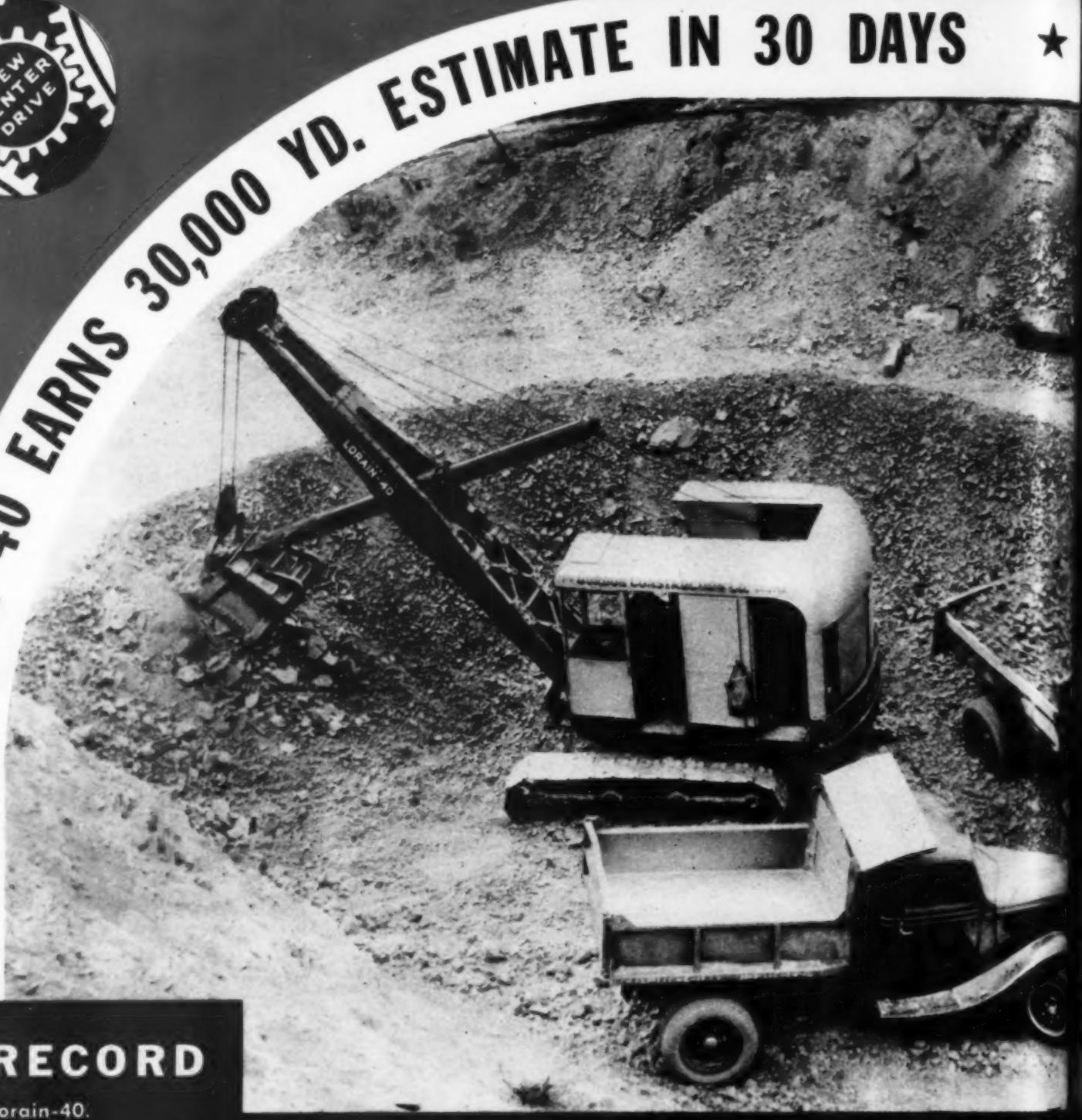


**"TRACTIONIZED" TARVIA PAVEMENT
IS SKID-SAFE AT ANY SANE SPEED**

THE BARRETT COMPANY New York Chicago Philadelphia Birmingham St. Louis Rochester Toledo Milwaukee Detroit
Baltimore Youngstown Cincinnati Buffalo Minneapolis Syracuse Bethlehem Providence Cleveland Hartford Portland, Me.
Lebanon Columbus Boston Norwood, N. Y. In Canada: THE BARRETT COMPANY, LTD. Montreal Toronto Winnipeg Vancouver



3/4 YD. LORAIN-40



THE RECORD

Unit: $\frac{3}{4}$ yd. Lorain-40.

Owner: Gordon Construction Co.,
Denver, Colo.

Job: 130,000 yd. highway grad-
ing job in Big Thompson
Canyon, Estes Park.

Material: Shot rock.

Height of working face: 12 ft.

Degrees of swing: 50°.

Hours worked per day: 12 hours.

Aver. yardage per day: 1000 yds.*

Disposal of material: To trucks
on 800 ft. haul.

*From Nov. 23rd to Dec. 25th, our estimate was
30,000 yds., working 12 hrs. daily."

LORAINS • 2 to $\frac{3}{8}$ yd.

The Lorain-40 offers you $\frac{3}{4}$ yd. capacity and profits at practically $\frac{1}{2}$ yd. weight and costs... It handles an honest $\frac{3}{4}$ yd. dipper at generous ranges; weighs only 33,000 lbs. — yet it has the power, speed and endurance to turn out records like these, because it is built on the new principle that Capacities depend on Stability and Strength, not Weight.

LORAINS

A black and white photograph of a Lorain 40 shovel in operation. The shovel is a large piece of heavy machinery with a long, articulated lattice boom extending upwards and outwards. It is dumping a load of material, likely sand or gravel, into the bed of a dark-colored pickup truck. The truck is positioned on a dirt surface, and the background shows a flat, open landscape with some sparse vegetation and utility poles in the distance. In the top right corner of the image, there is a small circular badge or logo with the text "THE NEW CENTER DRIVE" around the perimeter and "LORAIN" in the center. The overall scene conveys a sense of industrial activity and heavy-duty construction equipment.



Further proofs of the outstanding qualities of the L-40 are given in the "Performance is Convincing" booklet, written by Lorain owners, which gives similar details on 20 different jobs . . . Get a copy today; it explains why the Lorain-40 has become "The World's Fastest Selling $\frac{3}{4}$ Yd. Machine." The Universal Crane Co., Lorain, Ohio.

MOVE MORE MATERIAL, FASTER, AT LOWER COSTS

THE RECORD

Unit: $\frac{3}{4}$ yd. Lorgin-40.

Owner: Miller Gravel Co.,* Otisville, Mich.

Job: Stripping and loading gravel in pit.

Length of Boom: 40 ft.

Operating Radius: 25 ft.

Depth worked below treads: 25 ft.

Bucket: $\frac{3}{4}$ yd., heavy Page.

Hours worked per day: 10 hours.

Aver. daily yardage: 800 yards**

LORAINS 8 to 3½-1

LURAINS 2 10 1/8 yd.

LURAIN'S • 2 to 3/8 yd.

LURAINS • 2 to 3/8 yd.

800

FOR SATISFACTORY SERVICE

Choose...

BLAW-KNOX
portable, weighing
BATCHERPLANTS



BLAW-KNOX BULK CEMENT PLANTS are complete, including portable bins of various sizes; manual or automatic Weighing Batchers with beam scales or dial scales to meet all specification needs; cement elevators with gas engine or electric power; unloading equipment for hopper bottom car, box car, or truck delivery.

BLAW-KNOX PORTABLE BATCHERPLANTS for aggregate are furnished in a complete range of sizes with self-cleaning storage bins of one, two or three compartments.

Weighing Batchers are shipped completely assembled with scales, attached to the bin. Either beam scales or springless dial scales are supplied.

Blaw-Knox Batcherplants represent the ultimate in portability, speed, and convenience of use and operation

BLAW-KNOX CO.

2086 FARMERS BANK BUILDING, PITTSBURGH, PA.
Offices and Representatives in Principal Cities



15% to 25% MORE PROFIT from your Dragline Machine with a PAGE AUTOMATIC!

Read The Reports of Automatic Users: One contractor writes:

*We were amazed at the way the AUTOMATIC bucket handled the hard material especially on the slopes. We feel sure that we can figure an increase of 25% in yardage with the AUTOMATIC. We hope to be in the market for additional AUTOMATICS in the future.

Another user says:

*Our work was completed in three months—one-half the time we figured necessary. We find the AUTOMATIC bucket the most practical and profitable bucket to use on our type of excavation work.

* From letters in our files.

Ask other AUTOMATIC owners of their results with this patented rounded front bucket. Then see your equipment dealer or write us direct for information on an AUTOMATIC best suited to your machine and job. *Always remember*—as a profit earning tool, your dragline machine is only as good as the bucket you use!

"DIG WITH A PAGE AUTOMATIC"

Page Engineering Co.

Clearing Post Office " " Chicago, Ill.

PAGE AUTOMATIC DRAGLINE BUCKETS
PAGE WALKING DRAGLINE MACHINES
PAGE DIESEL ENGINES

PAGE ENGINEERING COMPANY
CLEARING POST OFFICE CHICAGO, ILLINOIS

Please send bulletin on the Automatic
Dragline Bucket in the _____ cu. yd. size

Name _____
Address _____
City _____ State _____ "S



Save MAN-HOURS and you save MONEY IN TUNNEL DRIVING OPERATIONS

**JUTE "VENTUBE" speeds up operations—
Amazingly durable, it stands up under
the toughest conditions**

THE ease and speed with which Jute "Ventube" can be handled saves many man-hours in tunnel driving. And that means real savings in your biggest cost item—labor.

Du Pont "Ventube" is hung from support wires quickly strung. It is rapidly withdrawn from the working face when blasting, and it saves more time by the rapidity with which it can be thrown up to the working face

The flexible

after blasting to exhaust gases, and permit a quicker return to work by the shift.

There's good reason for the durability of Jute "Ventube"—for its unusual resistance to fungus, acid water, gas or dry rot. It's made of extra-heavy, long-fibered Hessian cloth, impregnated and coated by a special process. There are no weak spots; it's as strong in tear resistance in the warp direction as in the filler. The durability of "Ventube" makes it truly economical.

Try a few sections of "Ventube" leading up to the working face and convince yourself of its strength and ease of handling.

ventilating duct



E. I. DU PONT DE NEMOURS & CO., INC.

Fabrikoid Division

FAIRFIELD

CONNECTICUT



ACTUAL
JOB DATA

1600-Foot Round Trip— 101 Cubic Yards Hourly

12-Yard Model "U" Expanding Carryall and "Caterpillar" RD8 getting a load of overburden at Binkley Mining Company's operations near Seelyville, Indiana.

Le TOURNEAU'S MODEL "U" STRIPS PROFITABLY

ANNOUNCING a selfish service

As an aid to selling equipment, we have created a Promotional Engineering Department, staffed by competent engineers, intimate through long experience on actual jobs with the problems of contractors and earthmoving engineers. It will be the business of this department to visit the major earthmoving projects of the country, to know the latest and best of current earthmoving practice, and to apply that knowledge to the problem of our prospects, to the end, frankly, of making more LeTourneau sales. Though formed to further sales and disseminate data, we know this department can be of real benefit to you, and we invite you to call on its members for aid in estimating and planning the best methods of handling your earthmoving problems.

To a tough stripping problem, complicated by mud, quicksand, and zero weather, Binkley Mining Company recently brought a LeTourneau U-12 Expanding Carryall Scraper pulled by a "Caterpillar" RD8. On an average round-trip haul of 1600 feet this outfit delivered 10 loads per hour, in 10 hours moved 1,011 cubic yards (actual pit measurement) — 101 cubic yards hourly — cut Binkley's stripping costs to a new low.

Try the new Expanding Carryall on your job. Its telescoping buckets will expand your yardage, cut your earthmoving costs as they did those of the Binkley Mining Company. The Model "U" is made in four sizes — 18-yard, 12-yard, 9-yard and 6-yard — to work with "Caterpillar" tractors from the RD8 to the RD4.

Ask your "Caterpillar" dealer for a demonstration.

LETOURNEAU

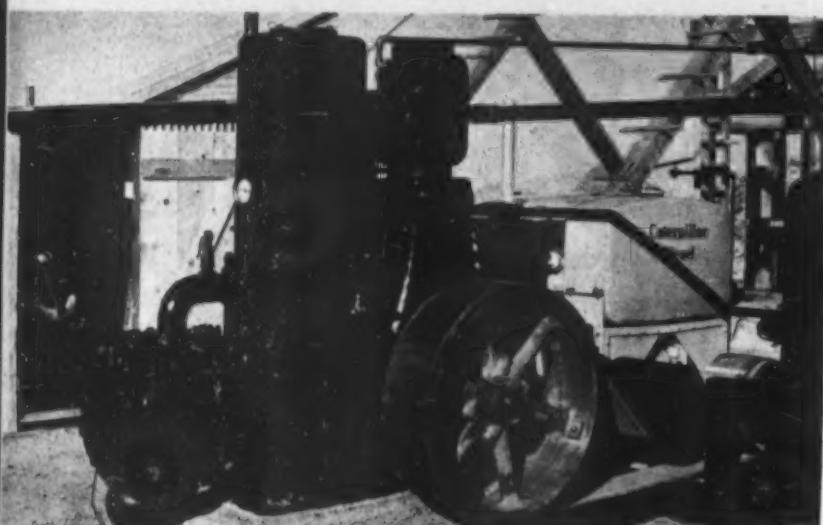
R. G. Le TOURNEAU, INC., Peoria, Illinois, Stockton, California, Cable Address: "Bobletorno"

Manufacturers of: Angledozers®, Buggies®, Bulldozers, Carryall® Scrapers, Cranes, Drag Scrapers, Power Control Units, Rooters®, Semi-Trailers

DRIVE IT WITH DIESEL AND DRIVE POWER COSTS

EARTH MOVING, rock crushing, air compressing—drilling, pumping, sawing—driving electric generators, hoisting machinery or shafting. . . .

SULLIVAN SUPPLIES THE AIR. Here's a Sullivan Air Compressor doing duty on a mining job in Nevada, powered at rock-bottom cost by a dependable Diesel engine bearing the mark of highest standard Diesel engineering: "Caterpillar."



There's one type of power that fits them all: Diesel—as perfected by the "world's largest manufacturer of Diesel engines." No job is too tough or too "different," for "Caterpillar" Diesel Engines. They're versatile. Dependable. And so economical that they spell "A-d-d-e-d P-r-o-f-i-t-s" in any language. Consuming low-priced fuel, and using it sparingly, these modern "dynamos of industry" are driving power costs down by ONE-HALF to THREE-FOURTHS.

Literature, cost figures and engineering suggestions on any general or special installations furnished on request. Address us or our nearest dealer.

SEVEN ENGINE SIZES

D17000 . . 8 cyl. . . 160 hp.	D8800 . . 4 cyl. . . 100 hp.
D13000 . . 6 cyl. . . 125 hp.	D7700 . . 4 cyl. . . 66 hp.
D11000 . . 6 cyl. . . 100 hp.	D6600 . . 3 cyl. . . 60 hp.
D4400 . . 4 cyl. . . 44 hp.	

CATERPILLAR

REG. U.S. PAT. OFF.

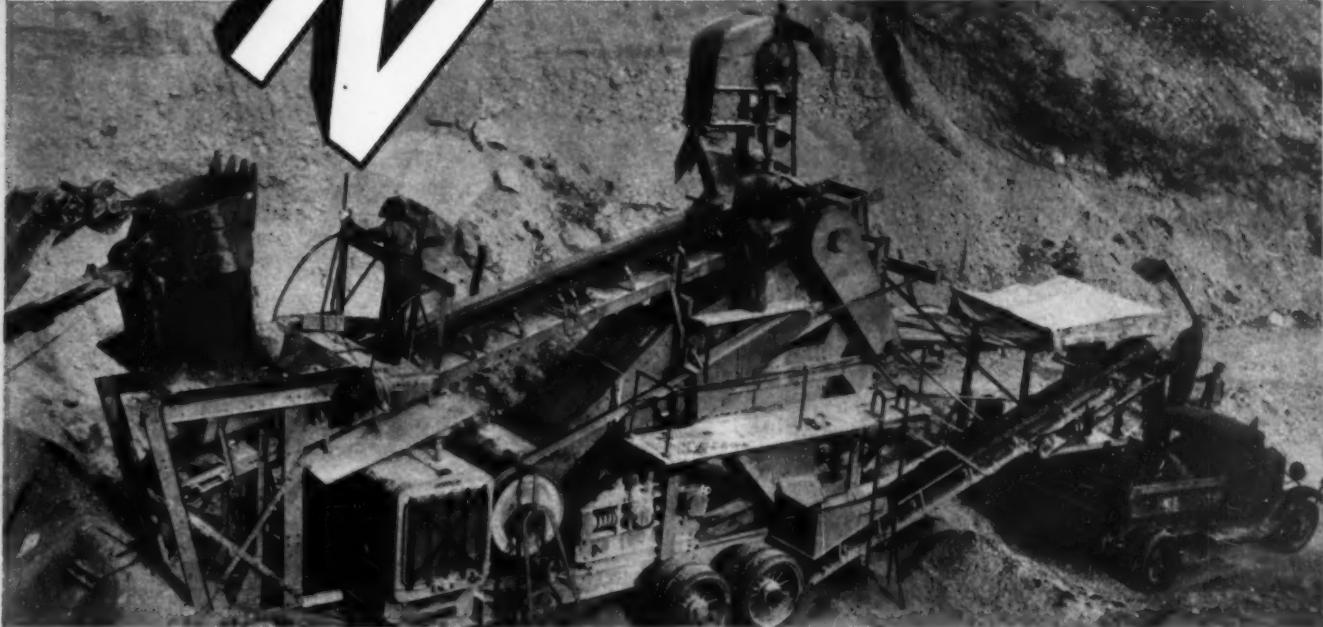
CATERPILLAR TRACTOR CO., PEORIA, ILL.



WORLD'S

HARNISCHFEGER P & H SHOVEL IN ACTION. Owned and operated by Jacob Udelhofen on road-building project at Coon Valley, Wis. Its 125-hp. "Caterpillar" Diesel Engine consumes only 25 gallons of cheap Diesel fuel per 10-hour day.

D
O
W
N



PORTABLE CRUSHING PLANT
—MADE BY UNIVERSAL and powered by a D13000 "Caterpillar" Diesel Engine—at work in the Zeitlow Pit, Wisconsin. Producing 500 to 700 yards a day on 4 gallons of 7.5c Diesel fuel per hour.

83 LEADING MANUFACTURERS POWER THEIR PRODUCTS WITH "CATERPILLAR" DIESEL ENGINES

Acme Road Machinery Co. Frankfort, N. Y.
Allsteel Products Mfg. Co., Inc. Wichita, Kans.
American Hoist & Derrick Co. St. Paul, Minn.
American Steel & Wire Co. Worcester, Mass.
Bay City Shovels, Inc. Bay City, Mich.
Berger Engineering Works, Inc., Seattle, Wash.
Bodinson Manufacturing Co. San Francisco, Calif.
Brookville Locomotive Company, Brookville, Pa.
The Browning Crane & Shovel Co. Cleveland, O.
The Buckeye Traction Ditcher Co. Findlay, O.
Bucyrus-Erie Company, South Milwaukee, Wis.
Buffalo Springfield Roller Co. Springfield, O.
Buhl Co., The Chicago, Ill.
Byers Machine Co., The Ravenna, Ohio
Canadian Sullivan Machinery Co., Ltd. Dundas, Ontario, Canada
Chase Turbine Co. Orange, Mass.
Chicago Pneumatic Tool Company, Franklin, Pa.
Clark Machinery Company, Wichita Falls, Texas
Clyde Iron Works, Inc. Duluth, Minn.
Cook, Inc., A. D. Lawrenceburg, Ind.
Cunningham Machinery Corp., Shreveport, La.

Davenport Besler Corporation Davenport, Iowa
Davey Compressor Co., Inc. Kent, Ohio
Diamond Iron Works, Inc. Minneapolis, Minn.
Dominion Hoist & Shovel Co., Ltd. Montreal, Quebec, Canada
Emsco Derrick & Equipment Co. Los Angeles, Calif.
Fate-Root-Heath Company, The, Plymouth, Ohio
Frick Co., Inc. Waynesboro, Pa.
Gardner-Denver Company (Canada) Ltd. Toronto, Ontario, Canada
Gardner-Denver Company Quincy, Ill.
Georgia Iron Works Augusta, Ga.
Gruendler Crusher & Pulverizer Co. St. Louis, Mo.
Gullet Gin Company Amite, La.
Hardie Manufacturing Co. Hudson, Mich.
Harmon, Alfred Melbourne, Australia
Harnischfeger Corporation Milwaukee, Wis.
Hendy Iron Works, Joshua, San Francisco, Calif.
Hopper Machine Works Bakersfield, Calif.
Hug Company, The Highland, Ill.
Industrial Brownhoist Corp. Bay City, Mich.
Iowa Manufacturing Co. Cedar Rapids, Iowa

Junior Monarch Hay Press San Leandro, Calif.
Kinney Manufacturing Co. Boston, Mass.
Koehring Company Milwaukee, Wis.
LeRoi Company Milwaukee, Wis.
Lima Locomotive Works, Inc. Lima, Ohio
Link-Belt Company Chicago, Ill.
Manitowoc Engineering Works, Manitowoc, Wis.
Marion Steam Shovel Co., The Marion, Ohio
Midwest Locomotive Works Hamilton, Ohio
Mission Manufacturing Co. Houston, Texas
Morris Machine Works Baldwinsville, N. Y.
Mundy Hoisting Engine Co., J. W. Elizabeth, N. J.
Novo Engine Company Lansing, Mich.
Oil Well Supply Co. Dallas, Texas
Orton Crane & Shovel Co. Huntington, Ind.
Osgood Company, The Marion, Ohio
Ottumwa Iron Works Ottumwa, Iowa
Pacific Placers Engineering Co., Los Angeles, Calif.
Parsons Company, The Newton, Iowa
Pioneer Gravel Equipment Mfg. Co. Minneapolis, Minn.
Pomona Pump Company Pomona, Calif.

Puget Sound Machinery Depot Seattle, Wash.
Randolph Company, O. W. Toledo, Ohio
Sauer Bros., Inc. Chicago, Ill.
Schramm, Inc. West Chester, Pa.
Speeder Machinery Company, Cedar Rapids, Ia.
Standard Steel Works Los Angeles, Calif.
Sterling Pump Corp. South Bend, Ind.
Sullivan Machinery Company Michigan City, Ind.
The Shovel Company, The Lorain, Ohio
Traylor Engineering & Mfg. Co. Allentown, Pa.
Unit Rig & Equipment Co. Tulsa, Okla.
Universal Crusher Co. Cedar Rapids, Iowa
Universal Power Shovel Corp. Milwaukee, Wis.
Vilter Manufacturing Co., The, Milwaukee, Wis.
Vulcan Iron Works Wilkes-Barre, Pa.
Washington Iron Works Seattle, Wash.
Western Knapp Engineering Co. San Francisco
Wheatley Bros. Pump & Valve Mfg. Co. Tulsa, Okla.
Whitcomb Locomotive Co., The Rochelle, Ill.
Wilson Manufacturing Co. Wichita Falls, Texas
Worthington Pump & Machinery Corp. Harrison, N. J.

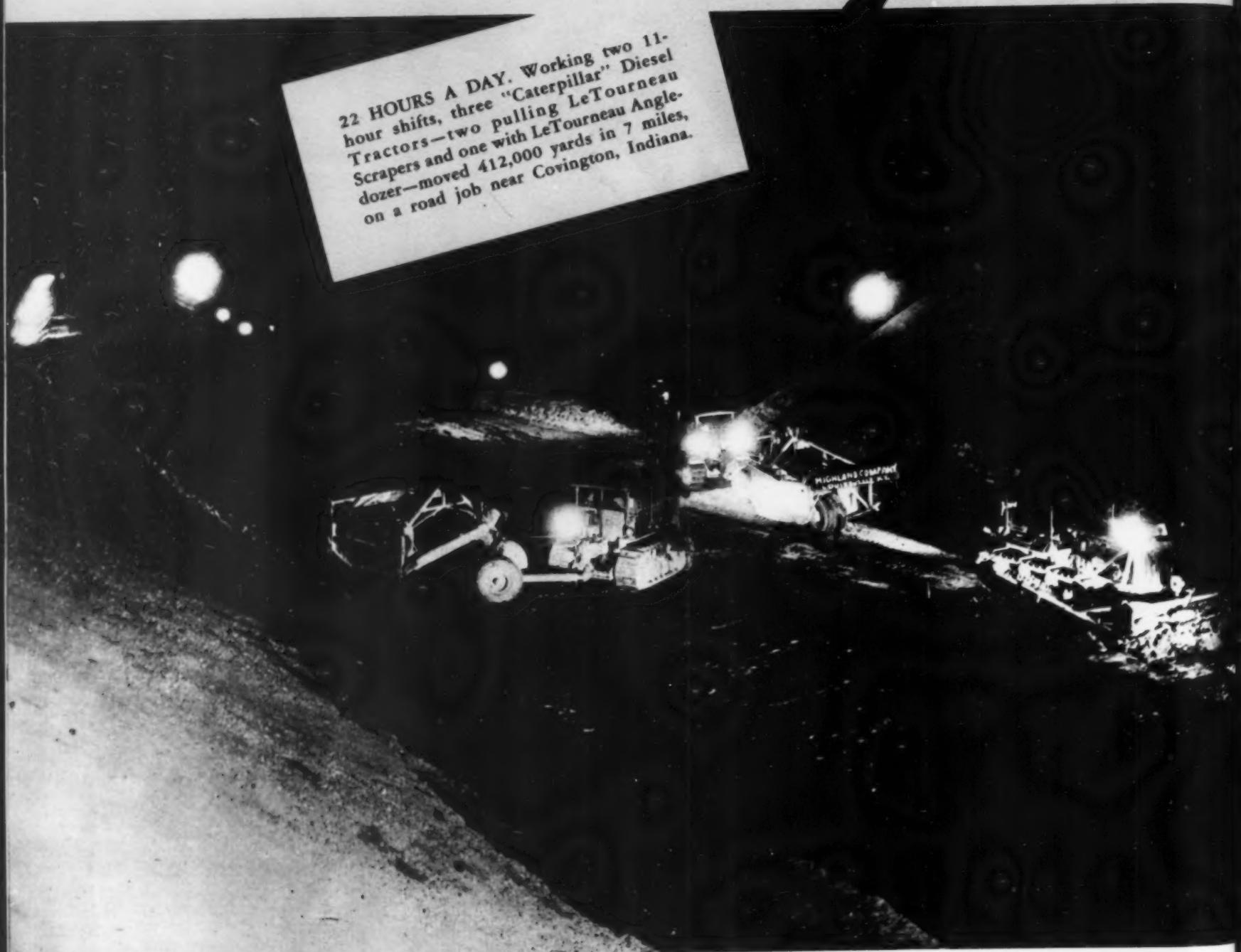
DIESEL ENGINES

LARGEST MANUFACTURER OF DIESEL ENGINES

WHERE TIME IS SHORT,

night

22 HOURS A DAY. Working two 11-hour shifts, three "Caterpillar" Diesel Tractors—two pulling LeTourneau Scrapers and one with LeTourneau Angle-dozer—moved 412,000 yards in 7 miles, on a road job near Covington, Indiana.



CATERPILLAR

REG. U. S. PAT. OFF.

"CATERPILLAR" DIESELS WORK

and day!

1,000,000 YARDS IN TWO MONTHS. Proving to be the most powerful and economical tractors in the world, "Caterpillar" Diesel RD8s, building the Marin County approach to the Golden Gate Bridge, made cuts and fills with scrapers and bulldozers—and moved 1,000,000 yards of dirt from July 1 to September 1, 1936.



Where the contract calls for a penalty date, you'll find "Caterpillar" Diesel Tractors at work. They are built for continuous service—and hundreds are on the job night and day, day in and day out, giving maximum performance at minimum costs, keeping the job going regardless of dust, mud and other tough conditions.

These tractors are first choice for the small jobs as well as the large ones. Get operating figures from a dealer.

TRACTOR CO.
PEORIA, ILL.



WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES,
TRACK-TYPE TRACTORS AND ROAD MACHINERY

Every outstanding

ARCHITECTURAL CONCRETE JOB YOU DO BUILDS A FUTURE FOR YOU

Specializing in concrete construction is one way of building business. *But specializing in topnotch concrete work is an even better way!*

It costs no more — and often costs less — to do a *good* job than a fair one. And every *good* job is a powerful advertisement that helps bring you more contracts.

Hundreds of schools, factories and other buildings are now being designed for architectural concrete. Get your share of this business by familiarizing yourself with the newest technique of making dense, uniform, water-resistant concrete . . . of building forms that are designed not merely to hold the concrete while it hardens, but to mold it into the architectural shapes desired.

Send for "Manual Forms for Architectural Concrete"; also "Concrete Guide with tables of quantities and materials."

PORTLAND CEMENT ASSOCIATION
Dept. 4-16, 33 W. Grand Ave., Chicago, Ill.

Clarke & Courts Building, Houston, Texas, was designed by Jos. Finger, Inc.; Walter P. Moore, structural engineer; Southwestern Construction Co., contractor — all of Houston. Forms for exterior facing of the walls were lined with plywood cut to size and shalacked before erection. Wood moldings were used for the horizontal bands; plaster waste molds for the lettering on the tower. The water-cement ratio method of proportioning the concrete, was used; aggregates were accurately graded; thorough hand puddling and mechanical vibration employed in placing. Entire surface of building painted with two coats of portland cement paint.



Architectural Concrete

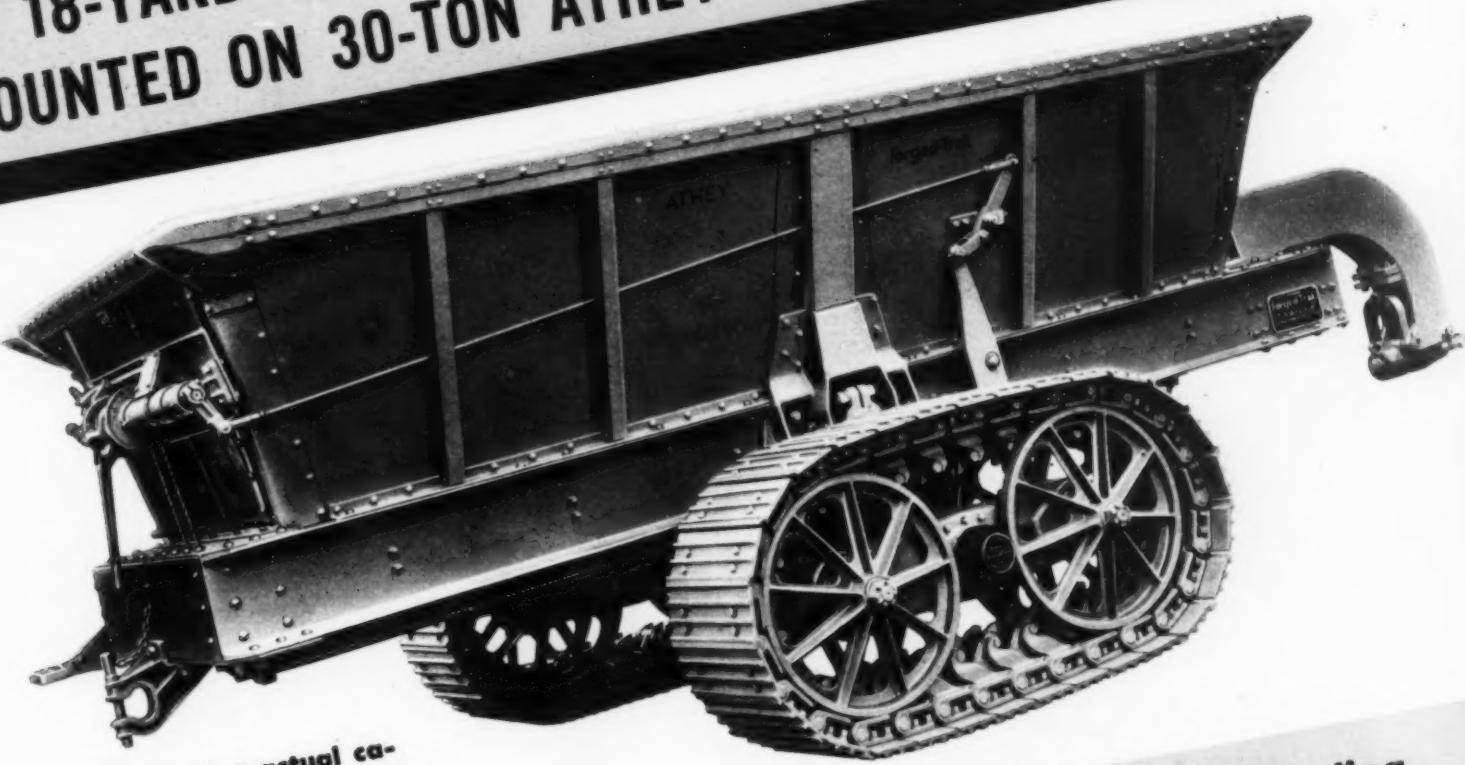
FRAME AND FLOORS CAST INTEGRAL
WITH EXTERIOR WALLS AND ORNAMENT



THE YEAR'S BIGGEST NEWS FOR DIRT-MOVERS!

ANNOUNCING

THE NEW 18-YARD ATHEY FORGED-TRAK BOTTOM-DUMP TRAILER
MOUNTED ON 30-TON ATHEY FORGED-TRAK WHEELS



Mounted on the first actual capacity 30-ton wheels on the market.

Carries capacity loads wherever track-type tractors can operate.

A worthy companion for the "Caterpillar" RD8 Tractor.

Axle and draw-bar spring mounted to absorb loading and road shocks.

Rigid construction for heavier loads.

Mechanical wind-up—simple and positive.

Athey Forged-Trak proved reliability in service.

Once again Athey leads in cutting dirt-hauling costs. The new 18-Yard Athey Forged-Trak Bottom-Dump Trailer offers you the larger capacity necessary to take advantage of the greater tractive power now available. For full details see your "Caterpillar" Dealer or write us.

ATHHEY TRUSS WHEEL CO.
5631 WEST 65TH STREET, CHICAGO, ILLINOIS
CABLE ADDRESS: "TRUSSWHEEL" CHICAGO

ATHHEY
Forged-Trak
(REG. TRADE MARK)

BOTTOM-DUMP TRAILERS
CAPACITIES FROM 5 TO 18 YARDS

KOEHRING



Two, of a fleet of Koehring Cranes and Draglines, at work on a Mississippi River dam construction project.



Seconds saved with every hoist and swing—more material handled in shorter time—Swing and hoisting time is reduced to a minimum with high speed Koehring Cranes and Draglines. Save where it counts — where saving means profits.

Own a Koehring and do it faster!

KOEHRING COMPANY
Pavers • Mixers • Shovels • Cranes • Draglines • Dumptors • Mud-Jacks
3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN

"We safeguard **all** our Diesels...
with
GULF LUBRICANTS"

SAYS THIS CONTRACTOR ON BIG HIGHWAY JOB

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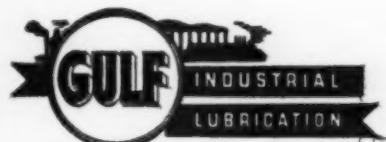
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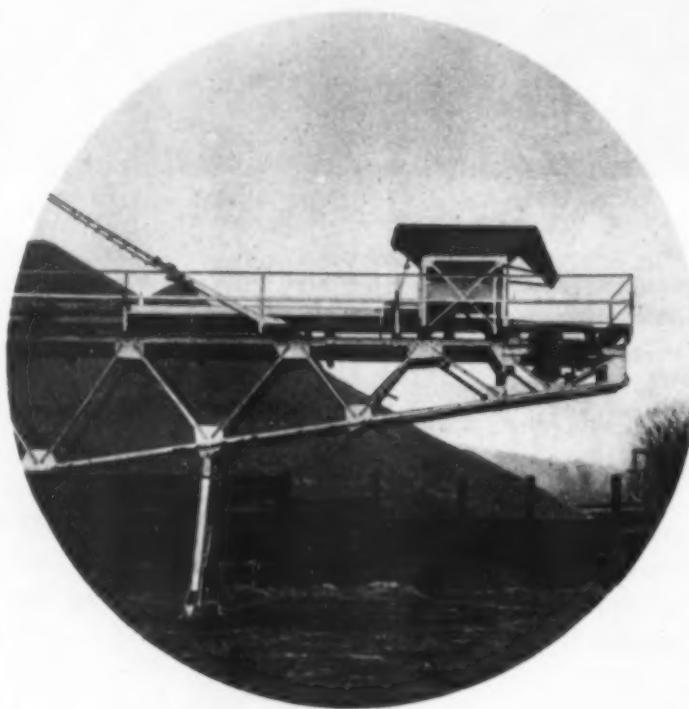


*Via
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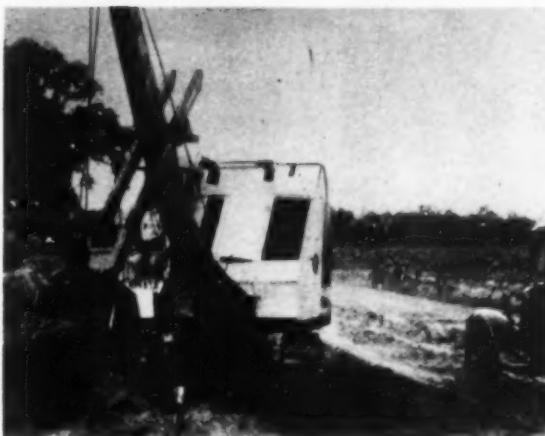
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• Pump casing in service on a dredge in harbor of San Diego, Calif. Its makers, Golden State and Miners Iron Works Co., of San Francisco, added 1.50 to 2% Nickel and 0.50% chromium to increase strength and resistance to wear and abrasion.

...when your
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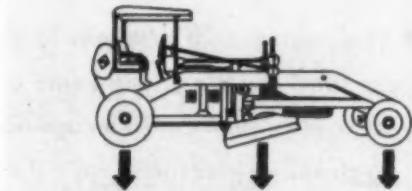
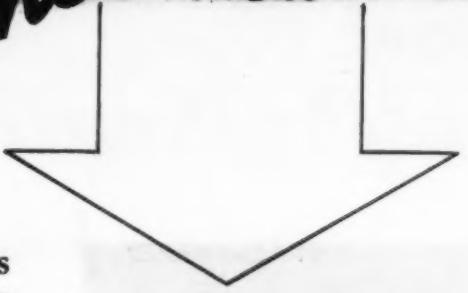
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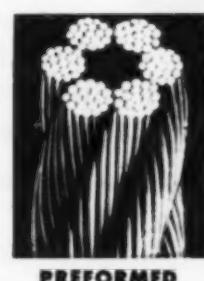
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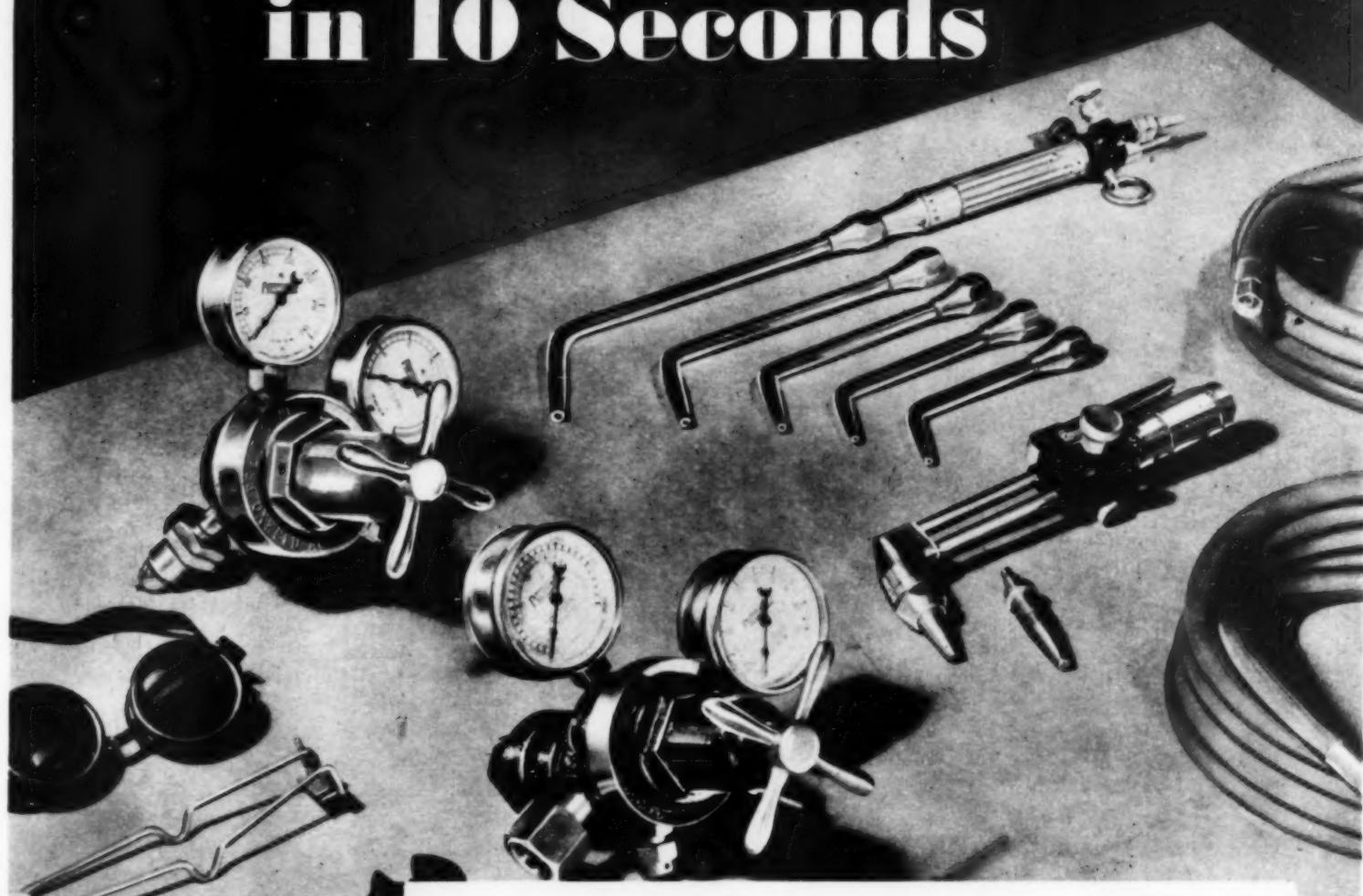


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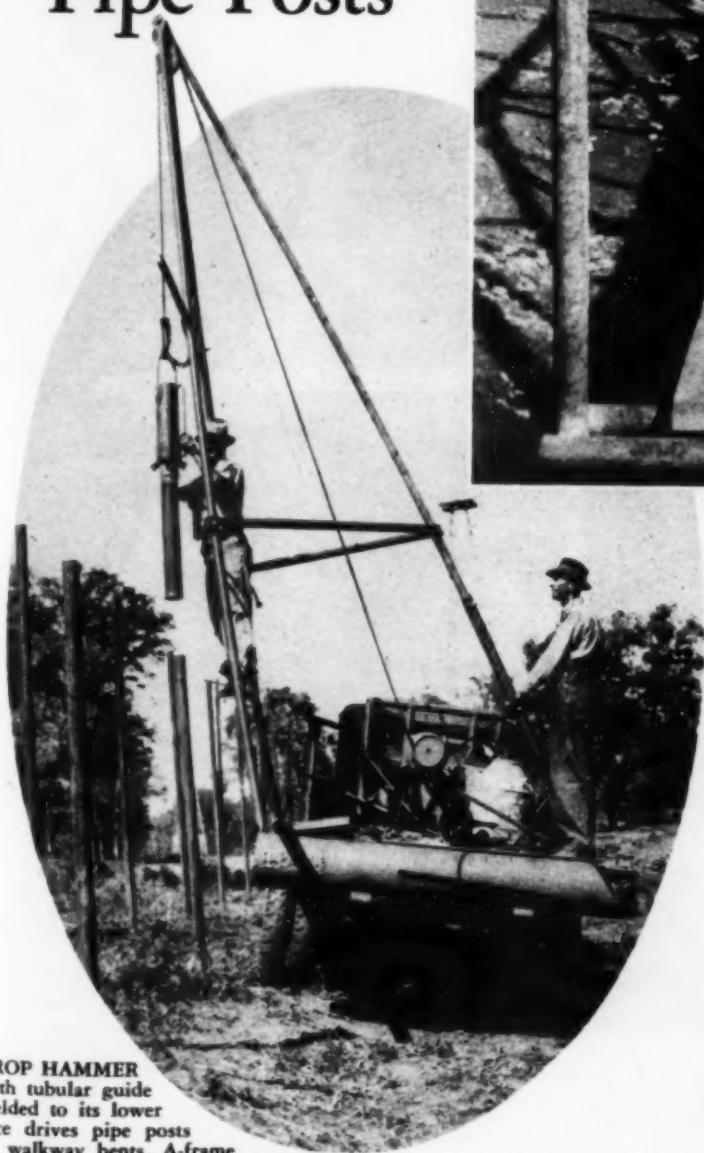
ROBERT K. TOMLIN, Editor

Volume 19

April, 1937

Number 4

DROP HAMMER On Truck-Mounted Adjustable A-Frame Drives Pipe Posts



DROP HAMMER with tubular guide welded to its lower face drives pipe posts of walkway bents. A-frame is hinged to permit adjustment in lining up hammer and post.



ELEVATED WALKWAY on welded tubular bents provides access to oil wells when river overflows. Joints in two-plank walk are staggered to stiffen structure.

TO PROVIDE flood-time access to 40 wells and two steam pumping stations on its river-bottom holdings in Texas, an oil company built an elevated system of walks, of 2-in. (scrap) pipe bents, spaced on 9-ft. centers, supporting a double row of 18-ft. Wolmanized planks.

After driving of vertical pipes with hand sledges had proved too arduous and slow, a post driver was devised and put together by welding. A tripod of 2-in. pipe was hinged to the flat body of a 1½-ton truck. The third leg of the tripod fitted inside a short length of 2½-in. pipe, likewise hinged to the truck bed, with an adjustable pin connection between leg and socket.

permitting the leg to be raised or lowered as required to line hammer and post.

From the A-frame of the tripod was suspended a hammer consisting of a 2-ft. length of 6-in. shafting, with a 2½-ft. length of 2½-in. pipe welded to its lower face. Power for the hammer was obtained from the truck engine, which drove a shaft mounted longitudinally on the truck body and equipped with a cat-head on the end away from the sprocket.

A manila line used to lift the 200-lb. tup was taken one turn around the cat-head to hoist its load. Slackening the tension caused the tup to drop. At an engine speed of 800 r.p.m. a maximum of 30 strokes per minute was possible, although rarely reached.

Using a gang of five men, it was possible to complete a bent every 2 min. and to average 150 per 8-hr. day. The gang consisted of one truck-driver, one "hammer-man" tailing the rope, one derrick-man to stand in the A-frame and control positioning of the hammer on its guide over the post, and two men to hold the post in position. As soon as the first blow was struck the two men on the ground acted as "sighters" or plumb-bob men, one on the line of the walk, the other at right angles to it, to insure straight driving. To eliminate fatigue, all jobs except driving the truck were rotated on 2-hr. intervals.

Sufficient cooling of the cat-head was obtained by filling the hollow casting with water at intervals through a hole at its center. The operators quickly learned to govern the tension in the rope so as not to burn it. A hook on the A-frame carried the hammer during shifts between bent sites.

With the mechanical driver the setting of 2,700 bents in 5 mi. of walks was completed in 18 days, enabling one gang of five men to keep ahead of a welder who followed them, tack-welding two 2-in. cross members on each bent and burning holes for bolting the planks. Faster driving time would have been possible had the truck been used solely for powering the "Iron Mule", as it was called, but the truck also hauled all material and workmen for the job.



This Month's "NEWS REEL"

MULTIPLE-ARCH SECTION

of Buchanan dam, begun several years ago, rises across lower Colorado River in Texas. Arches have span of 70 ft. Project, formerly known as Hamilton dam, is being built by Lower Colorado River Authority.



FIRST STEEL

rises on 400-acre artificial island site in San Francisco Bay for Golden Gate International Exposition in 1939. Structure illustrated is first of two airplane hangars each 335 ft. long by 287 ft. wide.



TRAVELING GANTRY

with hammerhead boom swings bottom-dump concrete bucket from car to forms in section of a spillway of Pickwick dam, being built across Tennessee River by Tennessee Valley Authority. Gasoline locomotive shifts standard-gage flat car carrying three 6-yd. buckets from mixing plant to crane.



TIMBER FRAMES

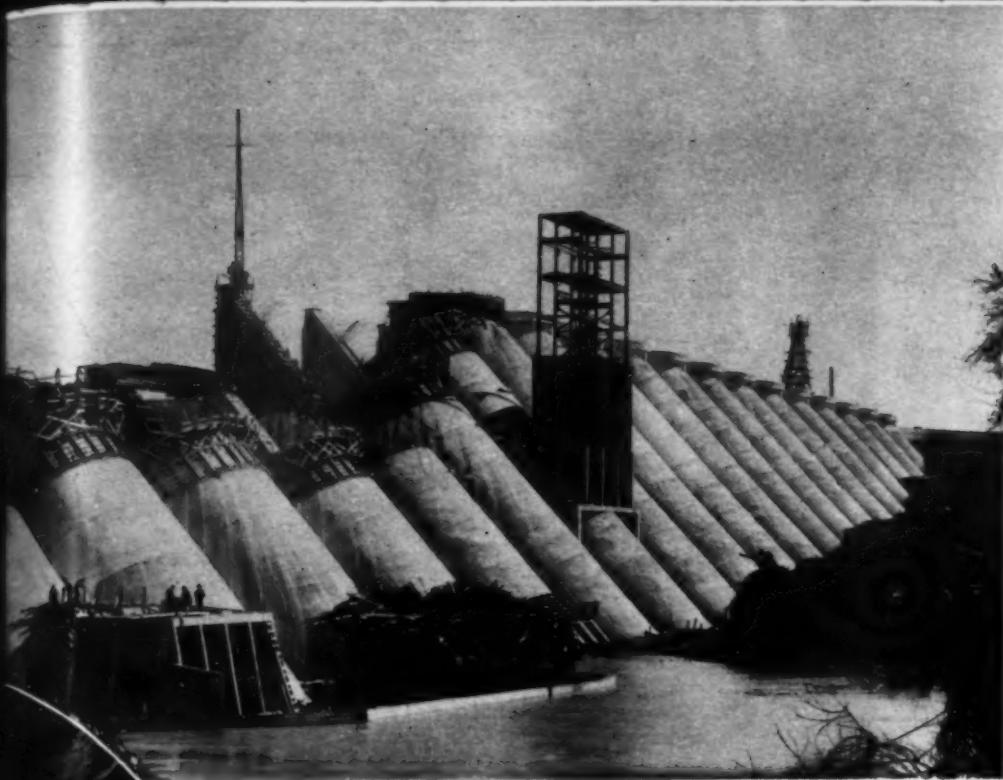
for Queens-Midtown tunnel under East River, New York, are set at top of Manhattan ventilating shaft by Triest Construction Co., New York. Prefabricated frames in four pieces, aggregating 72 tons in weight, are set after 60x110-ft. shaft had been excavated 20 ft. to rock. Then steel sheathing was installed. Shaft will have depth of 112 ft.

Acme Photo



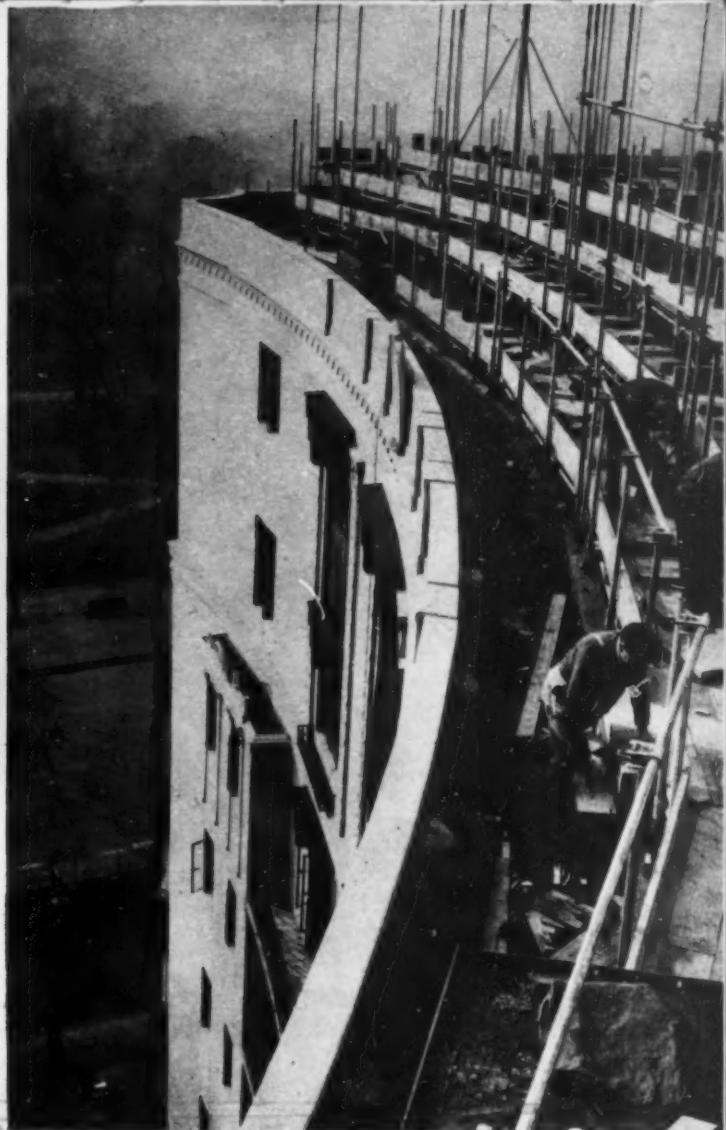
FLOATING ICE

is carried along channel of Columbia River passing through openings in west section of Grand Coulee dam around which stream was formerly diverted by cofferdam. Block of concrete in west section of dam, as shown in photograph, contains 1,850,000 cu.yd. and is 200 ft. high above lowest point of foundation.—Photo U. S. Bureau of Reclamation.



FOREST OF CONCRETE PILES

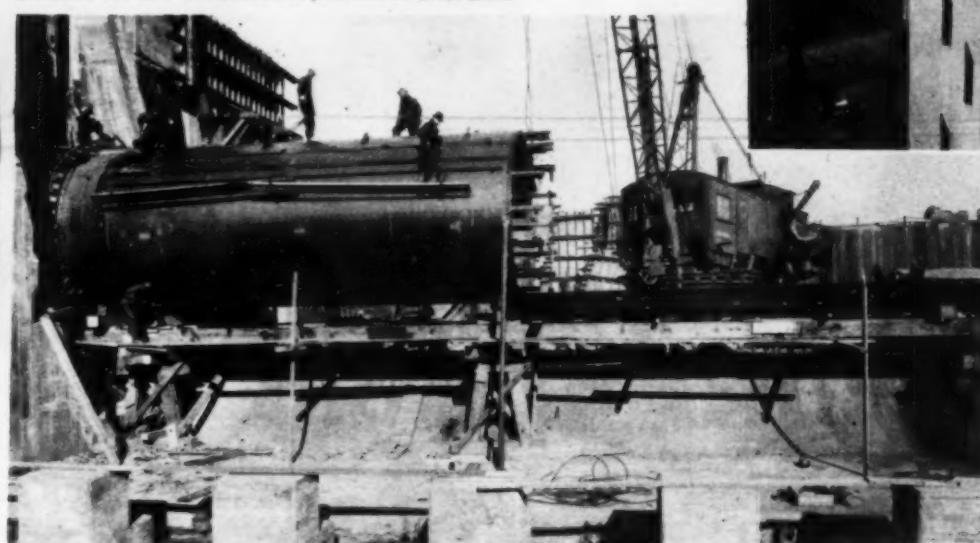
50 ft. in length (*left*) is driven into bed of Colorado River to serve as foundation for sluiceway gate structure at Imperial dam, 15 mi. north of Yuma, Ariz. Dam with main overflow section 1,200 ft. long and 31 ft. high, will divert river water into All-American Canal. Structure is being built for U. S. Bureau of Reclamation by Morrison-Knudsen Co., Utah Construction Co. and Winston Bros., on bid of \$4,374,240



Globe Photo

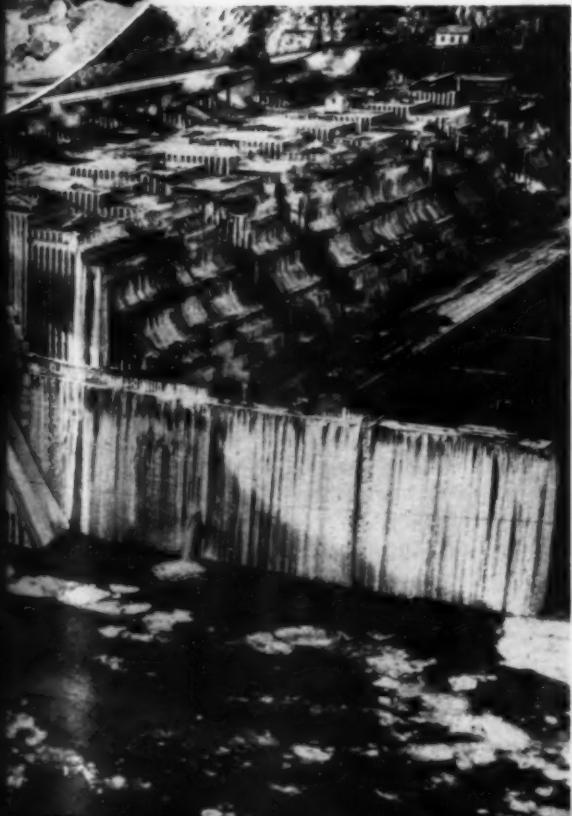
PREPARING FOR CORONATION,

pipe scaffolding is used for temporary stands, atop Dorchester Hotel, London, to accommodate crowds viewing ceremonies attending accession to throne of Britain's new King, George VI.



STEEL ROLLER GATE

(*above*) 100x20 ft., is erected at Dam 18 near Burlington, Iowa, one of structures in 9-ft. canalization program for the Upper Mississippi River. Gate is designed for maximum depth of flow of 10 ft. over crest and can be raised 5 ft. above extreme high water. Structure being built by S. A. Healy Co., of Chicago, at cost of \$2,507,000, includes three roller gates and 14 tainter gates each 60x20 ft.



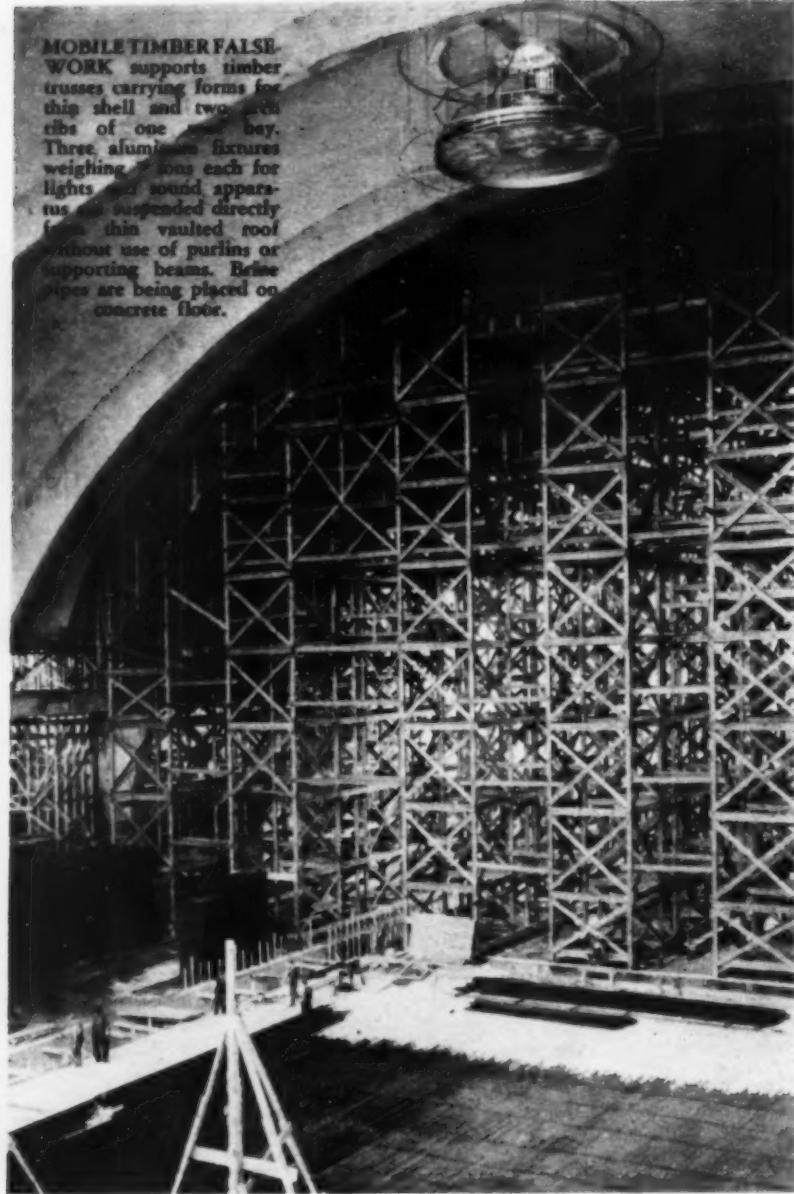
INDUSTRIAL CONSTRUCTION

makes spurt in Southwest as Atlantic Refining Co. pushes work on \$5,000,000 cracking and polymerization plant, on Neches River, near Port Arthur, Tex. In center is steel frame for cracking unit being built by M. W. Kellogg Company. First unit will have capacity of 24,000 barrels daily. Construction of this and other projects will increase oil refining capacity of Port Arthur plants to 250,000 barrels daily.

Page 44
THIN-SHELL BARREL ROOF of 232-ft. total span is stiffened by arch ribs spaced 39 ft. 2 in., c. to c. Each 78-ft. roof bay includes two ribs.

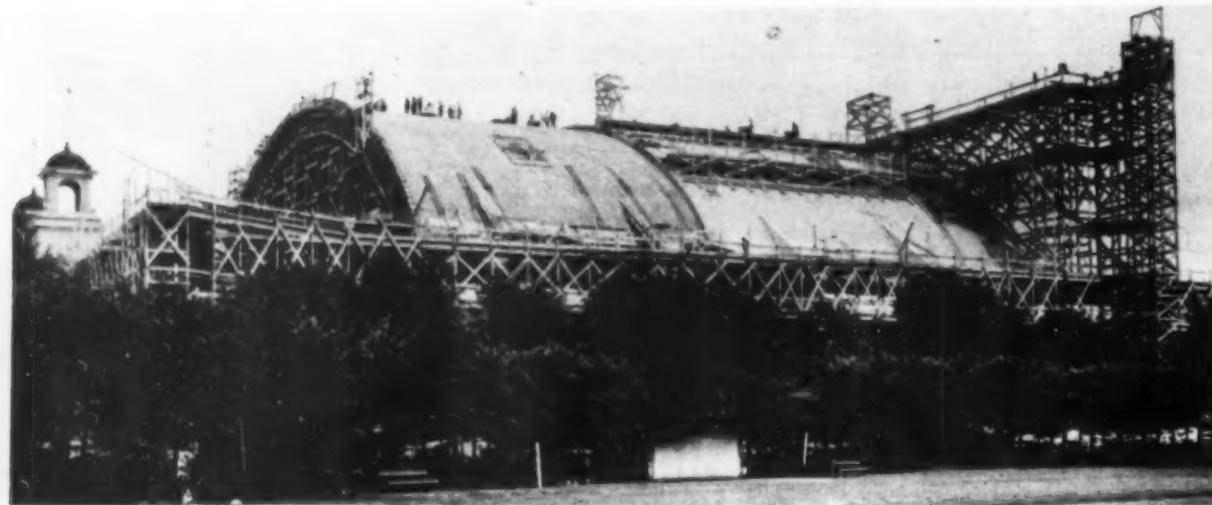


MOBILE TIMBER FALSEWORK supports timber trusses carrying forms for thin shell and two arch ribs of one roof bay. Three aluminum fixtures weighing 10 lbs each for lights and sound apparatus are suspended directly from thin vaulted roof without use of purlins or supporting beams. Brise sole pipes are being placed on concrete floor.



Thin-Shell CONCRETE BARREL ROOF

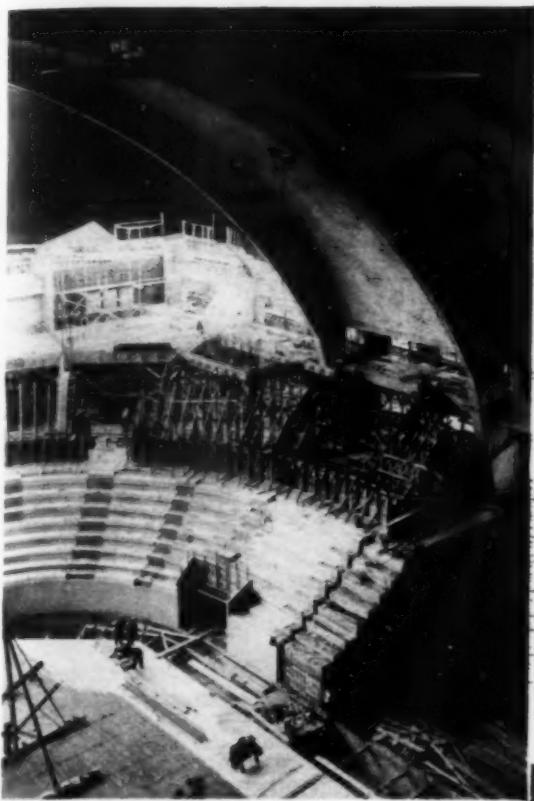
Stiffened by Two-Hinged Arches
Spans 232 Ft. Over Sports Arena



THIRD OF THREE CENTER BAYS, each 78 ft. wide, of long-span thin-shell roof is concreted with hand carts raised to runways at successively higher levels by tower elevators on two sides of building.

WITH COURAGE and skill befitting a construction organization of varied, if localized, experience, the Hershey Lumber Products, of Hershey, Pa., completed last fall for that small community of 2,500 persons the longest span concrete building in America. A barrel vault roof covering the great hall of the building has a reinforced-concrete shell only $3\frac{1}{2}$ in. thick stiffened at intervals of 39 ft. by two-hinged arch ribs spanning 222 ft. between hinge centers. In the longitudinal direction of the building the roof covers a total length of 343 ft. divided by expansion joints into five monolithic vault units 78 ft. long in the center bays and 51 ft. long in the end bays. Clearance above the floor at the crown of the vaulted roof is 100 ft. to the shell and 95 ft. to the bottom of the arch ribs.

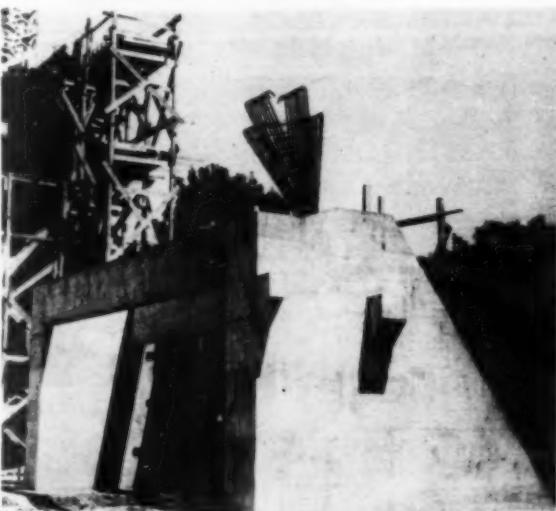
Utilizing mobile timber falsework and wooden forms, the construction organization completed the five roof units within a period of five months. Screw jacks mounted on the posts of timber falsework towers corrected form settlement during placing of concrete and controlled deflection of the ribs and shell during decentering.



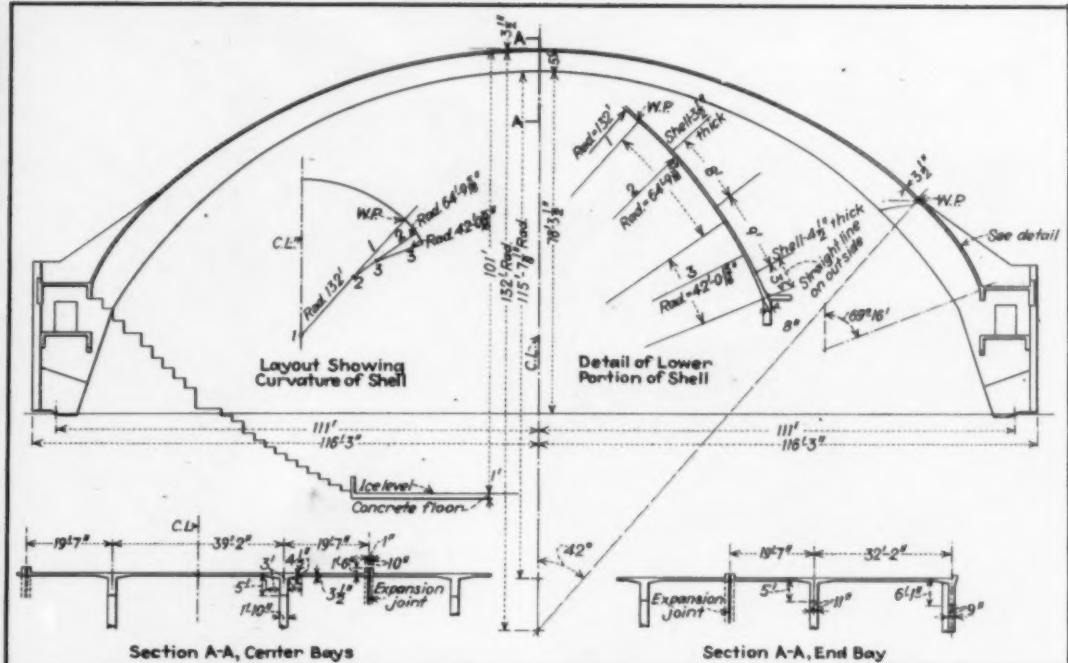
CONCRETE BLEACHERS seating 7,200 persons are constructed around four sides of ice rink. Mast erected on floor at lower left is center of radii for curved bleachers in corner.

Purpose and Size of Building — Designed primarily to accommodate home games of the Hershey club in the Eastern Amateur Hockey League, the building, known as the Hershey Sports Arena, seats 7,200 spectators on concrete bleachers surrounding the ice rink and takes care of 10,000 persons at events requiring less space for the spectacle. Outside dimensions at the base of the building are 245½ x 364 ft., and outside plan dimensions of the roof are 232½ x 343 ft.

Design — General dimensions, floor plans and seating arrangements were worked out by the architectural and engineering departments of Hershey Lumber Products. The building is concrete throughout. Outside organizations were consulted on special problems such as the thin-shell roof, designed in accordance with the Zeiss-Dywidag sys-



HINGE BARS protrude from tops of pair of foundation piers connected by longitudinal struts.



CROSS-SECTION OF MAIN ARCH FRAME measuring 222 ft. between hinges and 232½ ft. between outside limits of thin-shell roof.



TAUT STEEL WIRES leading from underside of arch ribs and roof shell to central control board reveal deflections against diagrams and charts during decentering, as indicated by Anton Tedesco, engineer in charge for Roberts & Schaefer Co.

tem for which the Roberts & Schaefer Co., of Chicago, are managers and agents in the United States.

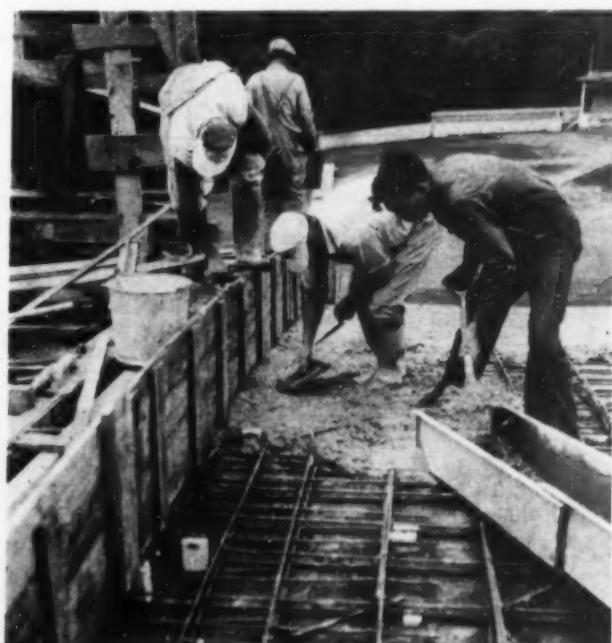
Thin-Shell Roof — Briefly interpreted, the Zeiss-Dywidag system as applied to thin-shell barrel vaults depends for its effectiveness upon (1) elimination of bending stresses from the thin shell and (2) transfer of the total thrust to the stiffening webs, or ribs, which rest on the supporting columns. This double result is achieved by arranging the center line of the shell roof in certain definite relation to the thrust line and by connecting the shell stiffly to the arch ribs. Edge beams at the springing line of the vault are required to stiffen the horizontal edge of the shell.

With bending eliminated, all stresses in the shell roof become direct stresses (compression and tension) which travel in inclined paths to the stiffening ribs, edge beams and, finally, to the piers. Reinforcing steel is placed in the

shell to resist the tension stresses. As the shell thickness then becomes dependent only upon the buckling effects of loads, extremely thin shells are possible. The accuracy and dependability of the system has been amply demonstrated both in theory and in practice.

Quantities — Construction of the sports arena and supplemental plants required in all 20,000 cu.yd. of concrete and 1,100 tons of reinforcing steel. Into the concrete went about 26,000 bbl. of cement, 18,000 tons of crushed rock and 15,000 tons of sand. Falsework for the roof construction required 200,000 b.ft. of yellow pine, and the total amount of lumber employed in the entire project was 500,000 b.ft. Practically all this lumber was in short lengths which were salvaged for future use in farm houses.

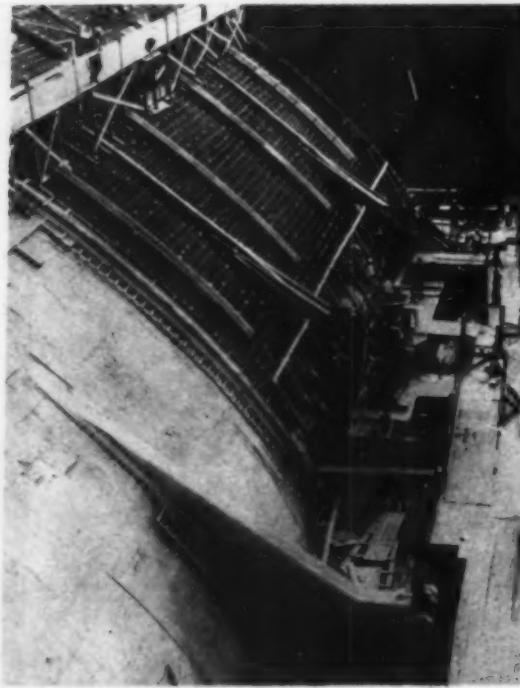
Acoustical lining on the inside of the roof took 100,000 sq.ft. of acousti-



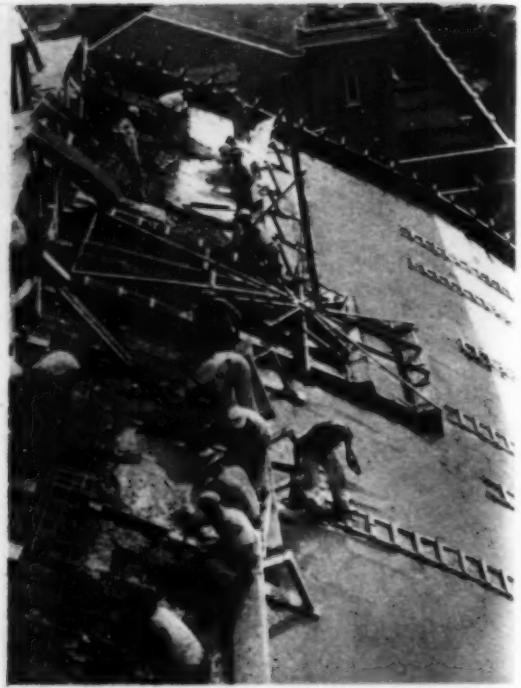
ROOF CONCRETE of workable consistency is placed and finished by hand. Workman at left is finishing concrete in shoulder at expansion joint.



HAUNCH SECTIONS of arch ribs erected above hinges are stiffened longitudinally by girders supporting passageway for which openings are left in arch ribs. Note screw jacks in place under haunch sections at hinges.



ROOF CONCRETING starts at lower edge on two sides of building simultaneously. Exterior forms are required for short distance above edge. Runways and chutes are in position to continue concrete placement from next higher level.

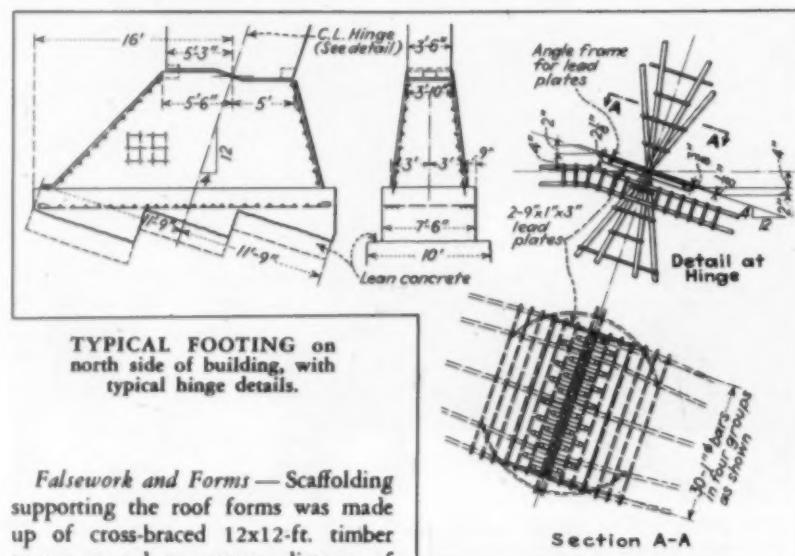


MOVABLE ROOF SCAFFOLD serves as platform or seat for puddlers and finishers on sloping side of barrel arch.

cal cork $1\frac{1}{2}$ in. thick. On the outside of the concrete shell fiber board insulation was applied to the amount of 75,000 b.ft. To freeze ice in the hockey rink, the floor was covered with 12 mi. of pipe to carry brine solution.

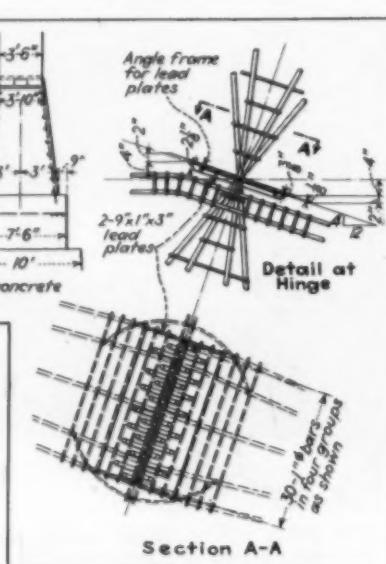
Piers and Hinges — To provide desired flexibility, allowing free movement of the arch ribs, the roof designers utilized an economical form of hinge which separates the concrete of the arch rib from contact with the concrete of the pier and transmits the arch thrust to the pier through a series of heavy steel bars intersecting at the center of the joint. Lead pads surrounding the steel bars at the intersection protect them from corrosion and permit relative rotation of the arch rib and pier.

Pier footings of lean concrete rest on foundations of limestone rock, clay, or clay and boulders. To save excavation and concrete, the footings are stepped in planes perpendicular to the thrust line of the arch. Above the footings, the concrete in the piers was mixed in proportions of about 1:2 $\frac{1}{4}$:3 $\frac{1}{2}$.



Falsework and Forms — Scaffolding supporting the roof forms was made up of cross-braced 12x12-ft. timber towers spaced an average distance of about 12 ft. apart. Each tower leg was made up of three 3x6-in. yellow pine timbers bolted together to form a 6x9-in. leg. Butt joints between timbers in the tower legs were filled out with shims to assure full load-carrying capacity.

On the timber falsework rested six lines of timber trusses conforming to



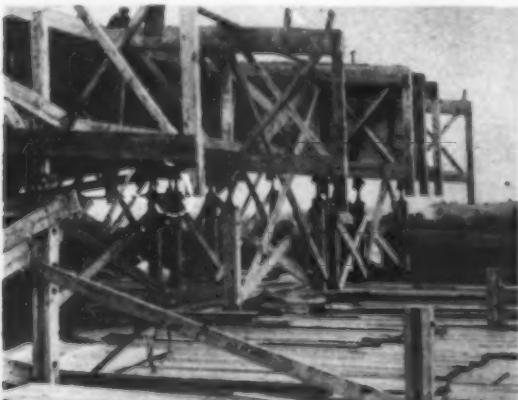
the curvature of the roof. The screw jacks already referred to were placed on tower legs under the curved trusses where they could be used to raise or lower the trusses as required. Each line of scaffold legs in the longitudinal direction of the building rested in a steel channel shoe. To facilitate movement

of the falsework, the mass of scaffolding was divided into two units which could be moved separately, one on either side of the center line.

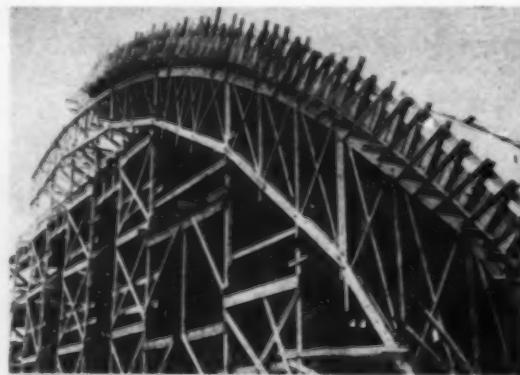
For the arch ribs and other exposed concrete work in the building, the erectors used forms lined with composition board. Ordinary wooden forms laid over timber joists served for the shell roof, the inner surface of which is lined with cork. Workmen checked the curvature of the roof form with wooden templets before the acoustical cork was applied. Reinforcing rods for the thin roof shell were tied to concrete blocks which supported them at the proper height above the cork.

Concrete Plants — Mixing and hoisting plants on two sides of the building served the roof construction. Each roof section was a monolithic unit comprising two arch ribs and the roof shell. For a 78-ft. center bay about 600 cu.yd. of concrete was required.

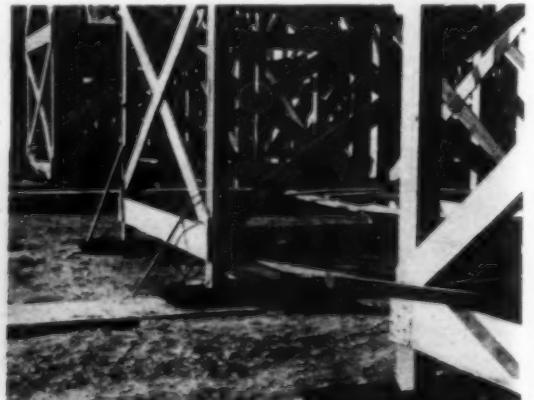
Concrete for the ribs and roof was mixed in 1:2 $\frac{3}{4}$:2 $\frac{1}{4}$ proportions of cement, sand and crushed limestone. The cement factor was 1.6 bbl. per cubic yard. All the coarse aggregate passed 1-in. square openings. Water added at



SCREW JACKS supporting timber trusses on falsework towers provide adjustments required in accurate setting and decentering of roof forms.

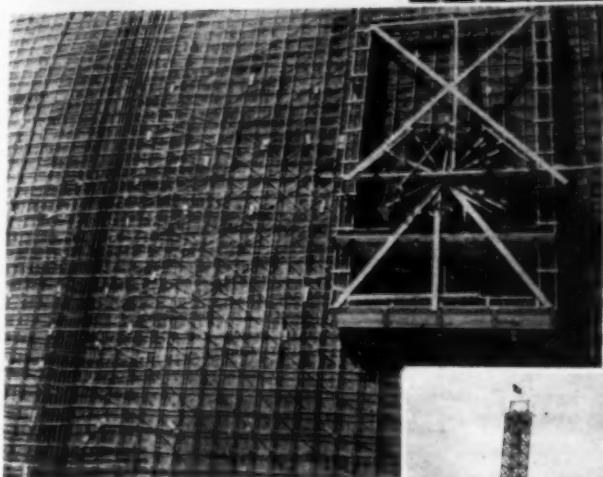


TIMBER TRUSSES resting on screw jacks on falsework towers support wooden deck of roof form. Bracketed side form at edge of roof deck is for shoulder at expansion joint.



ANGLE-IRON SHOES under falsework towers are drawn forward on small rollers on concrete runways when scaffolding is moved.

the mixer averaged 5 gal. per sack. Until concrete placing in each roof unit had progressed about two-thirds of the distance to the top, the batches for the ribs were made a little wetter than the batches for the thin shell, the difference amounting to about $\frac{1}{2}$ gal. per sack. The concrete was designed for 3,000-lb.-per-square-inch compressive strength at 28 days. Test cylinders



STEEL REINFORCEMENT is placed diagonally around ventilator opening to take care of stresses resulting from concentrated loading on thin shell. Roof has six openings for fans. Rib reinforcement appears at left.

averaged more than 4,000 lb. at this age.

Roof concrete was mixed in four two-sack mixers, two of which were placed on each side of the building at the base of the hoist tower. Sand and stone were batched by volume in wooden boxes on wheelbarrows. The mixers discharged into 6-cu.ft. hand carts which were raised four at a time on platform elevators in the timber hoist towers. Because of a difference in ground level, the tower on the south side was 100 ft. high and that on the north side 85 ft. high. The elevators were operated by electric hoists of 20- and 25-hp. capacity. At various levels the towers were connected by bridges with runways paralleling the sides of the roof.

Placing of concrete in a monolithic roof unit started at the lower edges and proceeded simultaneously up both sides to the crown, the ribs and roof shell keeping pace in their progress to the top. Outside forms were required for the lowest part of the roof, where the slope approaches the vertical, but for the remainder of the curved surface the thin shell was applied and finished without need of exterior forms. Concrete ordinarily was dumped from the carts into chutes. Where possible it was placed by dumping directly into the forms. Hand screeds and floats served for the finishing. Burlap kept wet by hosing was used for curing.

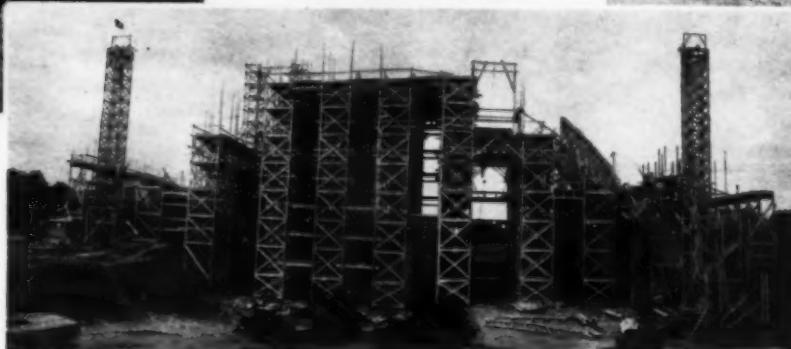
Control of Jacking — In all, 220 screw jacks of 10-ton capacity were utilized in controlling (1) the settlement of the forms during placing of concrete and (2) the stresses in the

EXTERIOR TREATMENT of Hershey Sports Arena is indicated by model photograph. Black lines on roof mark locations of expansion joints.

INTERIOR FALSEWORK, forms, hoist towers and scaffolding (below) employ large amount of lumber which will be used later for construction of agricultural buildings. Ground level at north (left) side of building is higher than at south side.



WOOD TEMPLET checks true curvature of roof form. Bolts protruding above form are to support runway. Portion of rib form has been lined with dark-colored tempered board.



roof shell during decentering. Twenty of the jacks were placed at the four hinges — five at each hinge — and the remaining 200 supported the six lines of trusses and the rib forms on the timber falsework.

Operation of the jacks was directed during both concrete placing and decentering by telephoned instructions from a central control station on the ground floor to which were strung wires (made of metal with negligible temperature expansion) from various points on the ribs and shell. For concrete placing a few wires attached at different points to the underside of the forms were led through a system of pulleys to the control board. Each wire was kept taut by a window weight attached to the free end. By noting the

rise and fall of these wires against a chart behind them on the control board the engineer in charge kept himself informed of the condition of jacks and forms.

For the process of decentering, a more refined and rigid control of deflections was required. In this case wires were reeved to the control station from five points on each of the two ribs, from three points on the shell between the ribs, and from three points on each portion of the shell cantilevered beyond the ribs — a total of nineteen wires. As indicated by an accompanying photograph, deflections of each of the ribs were measured against an arch diagram, while deflections of the intermediate and cantilevered shells were measured against

charts arranged in proper sequence with the rib drawings. Rib deflections were kept ahead of shell deflections to prevent the shell from carrying any part of the arch load. The engineer at the control board telephoned jacking directions to a foreman at the top of the scaffold. With sixteen men operating the jacks, about 3 hr. was sufficient to complete decentering.

Moving Falsework — Forms remained in place 10 days after concret-

ing of a roof section. Falsework moves were made with ease by using $\frac{3}{8}$ -in. round bars as rollers under the shoes and by anchoring chain blocks close to the scaffold, with a short length of cable between the chain block and the shoe.

Progress — Construction of the Hershey Sports Arena was undertaken in the spring of 1936, and the building was completed in time for a scheduled hockey game on Dec. 19. When work was going forward at the maximum rate, two shifts numbering 250 to 300 men in all were employed at the site.

Speed of placing concrete on the roof improved with each repetition of the operation. The three center bays were completed first. On the first unit, concreted in July, the operation took 70 hr. of continuous concrete placement, interrupted at times by a storm and by other delays which added considerably to the number of hours required. On the next section, placed in August, the work was completed in 39 hr., although delayed at one point by a hoist breakdown. The third of the center bays was concreted in 25 hr. on Sept. 10 and 11. During this third operation, the mixers averaged about eighteen batches per machine per hour.

Direction — D. Paul Witmer, manager, Hershey Lumber Products, was in general charge of design and construction. For the Roberts & Schaefer Co., designing and supervising engineers responsible for the Z.D. vaulted roof, Anton Tedesco directed both the design and erection. The recommendations of the Portland Cement Association as to standard concrete practice were followed. L. H. Doane, engineer, of Philadelphia, acted in an advisory capacity on the design and construction of walls and architectural concrete.

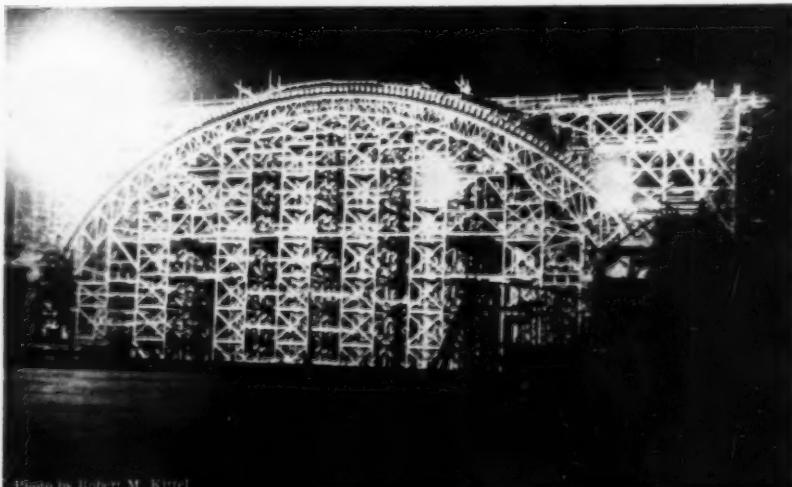


Photo by Robert M. Kriegel

CONTINUOUS PLACEMENT of concrete in monolithic roof bay requires night work under floodlights.

Labor and Material Costs

On Six Highway Jobs

LABOR AND MATERIAL COSTS on six contracts recently completed for a Mid-Western state highway department appear in accompanying tables. Six varieties or combinations of highway work are represented by the contracts: (1) grading and draining; (2) gravel surfacing; (3) grading, draining and concrete paving; (4) grading, draining and gravel surfacing; (5) steel and concrete single span bridge; (6) steel, concrete and treated timber bridge of three spans. Costs of the contracts were low, ranging from \$3,500 for Contract 2 to \$51,700 for Contract 3.

It must be understood that the costs given in the tables refer only to *labor and construction materials* utilized and expended in building the permanent physical improvement covered by the contract. They do not include liability and compensation insurance, taxes, cost of moving plant, equipment depreciation, office expense, overhead and profit or other items which entered into the total cost of completing the contracts. Several of these items are given for Contract 1, but even here the record is not complete. For



CONTRACT 1 involves more than 43,000 cu.yd. of common and borrow excavation for 1½ mi. of roadway grade 41 ft. wide.

Contract 1...Roadway Grading and Drainage

Length, 1.565 mi. To be completed in 180 days.						
Item	Unit	CONTRACT PRICES			Unit Price	Amount
		Estimated	Final	Quantity		
Clearing	Acres	1.40	1.395	\$75.00	\$ 105.00	\$ 104.63
Clearing	In. diam.	938	1,688	0.20	187.60	337.60
Grubbing	Acres	1.40	0.873	75.00	105.00	65.48
Grubbing	In. diam.	1,053	1,618	0.20	210.60	323.60
Common excavation	Cu. yd.	40,568	40,480	0.24 1/4	9,837.74	9,816.40
Borrow excavation	Cu. yd.	3,070	3,204	0.25	767.50	801.00
Finishing roadway	Sta.	83	83	5.00	415.00	415.00
Reinf. conc. culvert pipe, 24 in.	Lin. ft.	224	224	3.00	672.00	672.00
Reinf. conc. culvert pipe, 30 in.	Lin. ft.	192	192	4.00	768.00	768.00
Corr. galv. sheet metal culvert pipe, 18 in.	Lin. ft.	328	308	2.00	656.00	616.00
Corr. galv. sheet metal culvert pipe, 24 in.	Lin. ft.	76	94	2.50	190.00	235.00
Riprap	Cu. yd.	61	69.24	2.60	158.60	180.02
Marker posts	Each	45	45	2.00	90.00	90.00
Seeding	Sq. yd.	77,655	77,655	0.005	388.28	388.28
Excavation for culverts	Cu. yd.	320	328	1.00	320.00	328.00
Concrete for culverts	Cu. yd.	150	151	20.00	3,000.00	3,020.00
Bar steel reinforcement	Lb.	13,320	13,320	0.045	599.40	599.40
Waterproofing	Sq. ft.	4,000	4,000	0.11	440.00	440.00
MINIMUM WAGES AND HOURS			Total		\$18,910.72	\$19,200.41
Skilled labor			Penalty, 18 days at \$5.00		90.00	
Intermediate labor			Total payments			\$19,110.41
Unskilled labor						
Required employment, 14,000 man-hours.						
LABOR COSTS						
Classification	Man-Hours	Wages	RENTED EQUIPMENT			
Executive, administrative, and supervisory	2,548 1/2	\$ 1,552.54	Power shovel	\$ 500.00		
Skilled	1,407	973.05	Tractor, 60-hp.	500.00		
Intermediate	4,299	2,508.02	Trucks	1,929.75		
Unskilled	11,928	5,466.82	Boiler	140.00		
Total	20,182 1/2	\$10,500.43	Machinery	390.00		
MATERIAL COSTS						
Materials	Quantity	Total Cost	Power shovel	\$ 500.00		
Portland cement, bbl.	243.75	\$ 641.05	Tractor, 60-hp.	500.00		
Asphaltic cement, gal.	203.00	49.70	Trucks	1,929.75		
Stone, cu. yd.	70	5.00	Boiler	140.00		
Gravel, cu. yd.	168.5	281.22	Machinery	390.00		
Sand, cu. yd.	100.5	147.20	Mixer, 21-S	75.00		
Reinforcing steel, lb.	13,325	392.85	Horses	16.00		
Lumber, 1,000 ft. b.m.	8,013	343.85	Total	\$3,550.75		
Concrete culvert pipe, ft.	416	816.96	REPAIRS			
Metal culvert pipe, ft.	428	500.69	To 30-hp. tractor	\$ 314.85		
Motor fuel		2,291.60	To crane and shovel	485.52		
Borrow excavation; cu. yd.	3,204	80.10	To trucks	636.00		
Stump storage		20.00	Total	\$1,436.37		
Marker posts	45	47.49	MOVING EQUIPMENT			
Aluminum paint, gal.	5	23.36	Crane	\$ 70.00		
Black paint, gal.	1	2.78	Shovel	70.00		
Grass seed		83.63	Tractor, 60-hp.	40.00		
Bituminized cotton fabric, sq. yd.	250	53.86	Tractor, 30-hp.	20.00		
Coke for heating, tons	2.735	30.09	Grader	25.00		
Miscellaneous hardware		186.13	Mixer	14.00		
Office supplies		85.00	Total	\$239.00		
Total		\$ 6,082.56	REPAIRS			
Automobile expense, 180 days			To 30-hp. tractor	\$ 314.85		
Grand total, materials and equipment costs			To crane and shovel	485.52		
			To trucks	636.00		
			Total	\$1,436.37		
			MOVING EQUIPMENT			
			Crane	\$ 70.00		
			Shovel	70.00		
			Tractor, 60-hp.	40.00		
			Tractor, 30-hp.	20.00		
			Grader	25.00		
			Mixer	14.00		
			Total	\$239.00		
			REPAIRS			
			To 30-hp. tractor	\$ 314.85		
			To crane and shovel	485.52		
			To trucks	636.00		
			Total	\$1,436.37		
			MOVING EQUIPMENT			
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			Grader	25.00		
			Mixer	14.00		
			Total	\$239.00		
			REPAIRS			
			To 30-hp. tractor	\$ 314.85		
			To crane and shovel	485.52		
			To trucks	636.00		
			Total	\$1,436.37		
			MOVING EQUIPMENT			
			Crane	\$ 70.00		
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			Tractor, 60-hp.	40.00		
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			Grader	25.00		
			Mixer	14.00		
			Total	\$239.00		
			REPAIRS			
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			Tractor, 60-hp.	40.00		
			Tractor, 30-hp.	20.00		
			Grader	25.00		
			Mixer	14.00		
			Total	\$239.00		
			REPAIRS			
			To 30-hp. tractor	\$ 314.85		
			To crane and shovel	485.52		
			To trucks	636.00		
			Total	\$1,436.37		
			MOVING EQUIPMENT			
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			Grader	25.00		
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			Total	\$239.00		
			REPAIRS			
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			Grader	25.00		
			Mixer	14.00		
			Total	\$239.00		
			REPAIRS			
			To 30-hp. tractor	\$ 314.85		
			To crane and shovel	485.52		
			To trucks	636.00		
			Total	\$1,436.37		
			MOVING EQUIPMENT			
			Crane	\$ 70.00		
			Shovel	70.00		
			Tractor, 60-hp.	40.00		
			Tractor, 30-hp.	20.00		
			Grader	25.00		
			Mixer	14.00		
			Total	\$239.00		
			REPAIRS			
			To 30-hp. tractor	\$ 314.85		
			To crane and shovel	485.52		
			To trucks	636.00		
			Total	\$1,436.37		
			MOVING EQUIPMENT			
			Crane	\$ 70.00		
			Shovel	70.00		
			Tractor, 60-hp.	40.00		
			Tractor, 30-hp.	20.00		
			Grader	25.00		
			Mixer	14.00		
			Total	\$239.00		
			REPAIRS			
			To 30-hp. tractor	\$ 314.85		
			To crane and shovel	485.52		
			To trucks	636.00		
			Total	\$1,436.37		
			MOVING EQUIPMENT</td			



CONTRACT 3 covers 2 mi. of 20-ft. concrete paving, with considerable lip curb. In background, old road appears at right and relocation at left. **DRAINAGE OUTLET** (left) is designed to prevent erosion.

the five other contracts, no items except labor and construction materials are noted.

All projects were built with Works Program funds, hours of manual labor being restricted for each worker to 8 per day and 130 per month. Required man-hours of employment (hired through the U. S. Reemployment Service) are noted in the tables relating to each contract. On each job actual employment from this designated source exceeded the requirement by the following amount: Contract 1, 33 per cent; Contract 2, 4.3 per cent; Contract 3, 22.4 per cent; Contract 4, 24.8 per cent; Contract 5, 12.8 per cent; Contract 6, 11.7 per cent. In every case actual employment exceeded the amount required by a sufficient margin to indicate that no labor was carried beyond its useful working period merely to

Contract 3... Grading and Concrete Paving

Length, 1.991 mi. To be completed in 225 days.

CONTRACT PRICES

CONTRACT PRICES				Amount	
		Estimated	Final	Estimated	Final
Clearing	In. diam.	261	271	\$ 104.40	\$ 108.40
Grubbing	In. diam.	273	359	150.15	197.45
Removing concrete pavement	Sq. yd.	6,850	6,509	0.55	0.55
Common excavation	Cu. yd.	13,701	15,580	0.30	0.30
Excavation for structures, culverts	Cu. yd.	465	535	0.35	0.35
Shoulder embankment	Cu. yd.	6,234	6,046	0.35	0.35
Finishing roadway	Sta.	106	106	18.00	18.00
Concrete pavement	Sq. yd.	13,692	13,548	1.65	1.65
Concrete pavement widening	Sq. yd.	2,957	2,243	1.79	1.79
Lip curb, 2 in.	Lin. ft.	2,380	2,297	0.10	0.10
Lip curb, 4 in.	Lin. ft.	1,280	1,259	0.15	0.15
Concrete surface drains	Cu. yd.	34.2	36	13.00	13.00
Concrete pavement reinforcement	Cu. yd.	2,317	2,099	0.21	0.21
Gravel, surface course	Cu. yd.	300	300	0.89	0.89
Concrete masonry, culverts	Cu. yd.	232.3	222.92	28.50	28.50
Bar steel reinforcement, culverts	Lb.	12,720	12,720	0.045	0.045
Structural steel	Lb.	420	420	0.10	0.10
Reinf. conc. culvert pipe, 24 in.	Lin. ft.	180	180	3.00	3.00
Reinf. conc. culvert pipe, 30 in.	Lin. ft.	52	52	4.50	4.50
Corr. galv. sheet metal culvert pipe, 18 in.	Lin. ft.	300	226	1.40	1.40
Corr. galv. sheet metal culvert pipe, 24 in.	Lin. ft.	106	114	2.00	2.00
Corr. galv. sheet metal culvert pipe, 30 in.	Lin. ft.	24	24	2.60	2.60
Waterproofing	Sq. ft.	4,125	4,785	0.06	0.06
Riprap	Cu. yd.	84	76.3	4.00	4.00
Cable guard fence	Lin. ft.	128	128	0.75	0.75
Anchorage for cable guard fence	Each	4	4	8.00	8.00
Marker posts	Each	44	44	2.50	2.50
Seeding	Sq. yd.	62,000	59,715	0.007	0.007

Extra work resulting from change order.

Concrete pavement	Sq. yd.	2,383.1	1.65	\$ 3,932.12
Removing concrete pavement	Sq. yd.	1,906.5	0.30	571.95
Concrete pavement reinforcement	Sq. yd.	3,436	0.21	721.56
	Total			\$55,578.52

MINIMUM WAGES AND HOURS

Skilled labor	\$ 0.70 per hour
Intermediate labor	0.60 " "
Unskilled labor	0.50 " "
Required employment,	28,500 man-hours.

LABOR COSTS

Classification	Man-Hours	Wages
Executive, administrative, and supervisory	6,744	\$ 4,414.92
Skilled	3,003	2,102.10
Intermediate	10,264 1/2	6,189.50
Unskilled	15,782	7,915.93
Total	35,793 1/2	\$20,622.45

MATERIAL COSTS

Materials	Quantity purchased	Quantity produced locally
	Total Cost	Cost by contractor
Portland cement, bbl.	5,327	\$13,690.39
Tar products, gal.	2,876	197.92
Stone, cu. yd.	2,649	3,282.86
Sand, cu. yd.	1,770	2,188.57
Structural steel, lb.	421	15.16
Reinforcing steel, lb.	135,867	1,997.02
Lumber, 1,000 ft. b.m.	9,212	417.73
Concrete culvert pipe, ft.	228	293.40
Metal culvert pipe, ft.	382	357.54
Motor fuel, gal.	12,949	2,412.11
Miscellaneous materials		1,566.51
Total		\$26,419.21

Contract 4... Grading and Gravel Surfacing

Length, 1.892 Mi. To be completed in 200 days.

CONTRACT PRICES

CONTRACT PRICES				Amount	
		Estimated	Final	Estimated	Final
Clearing	Acres	7.0	1.0	\$ 90.00	\$ 90.00
Grubbing	Acres	7.0	3.0	120.00	360.00
Common excavation	Cu. yd.	9,742	9,438	0.25	2,435.50
Borrow excavation	Cu. yd.	21,178	13,596	0.30	6,353.40
Finishing roadway	Sta.	100	100	6.00	600.00
Gravel surface course	Cu. yd.	3,727	3,699	1.20	4,472.40
Corr. galv. sheet metal culvert pipe, 18 in.	Lin. ft.	220	220	1.33	292.60
Corr. galv. sheet metal culvert pipe, 24 in.	Lin. ft.	86	88	2.04	175.44
Corr. galv. sheet metal culvert pipe, 30 in.	Lin. ft.	192	208	2.61	501.12
Corr. galv. sheet metal culvert pipe, 36 in.	Lin. ft.	182	182	4.23	769.86
Riprap	Cu. yd.	80	80.5	3.00	240.00
Marker posts	Each	36	36	1.75	63.00
Seeding	Sq. yd.	44,500	44,500	0.005	222.50
	Total			\$17,595.82	\$14,238.96

MINIMUM WAGES AND HOURS

Skilled labor	\$ 0.70 per hour
Intermediate labor	0.60 " "
Unskilled labor	0.50 " "
Required employment.	11,300 man-hours.

LABOR COSTS

Classification	Man-Hours	Wages
Executive, administrative, and supervisory	2,352	\$ 1,655.20
Skilled	406 1/2	336.45
Intermediate	4,328 1/2	2,597.10
Unskilled	7,439 1/2	3,719.75
Total	14,526 1/2	\$ 8,308.50

MATERIAL COSTS

Materials	Quantity	Total Cost
Gravel borrow, cu. yd.	3,699	\$ 295.92
Earth borrow, cu. yd.	13,576	531.15
Metal Culvert pipe, ft.	698	899.10
Motor fuel, gal.	12,000	2,073.98
Miscellaneous materials		490.21
Total		\$ 4,290.36



CONTRACT 4 calls for grading, draining and gravel surfacing of almost 2 mi. of 26-ft. roadway.

raise the total of man-hours. On the other hand, high man-hour requirements probably prevented the contractors from mechanizing the jobs in the most efficient manner.

An obvious analysis of employment on the six contracts is suggested by the table on the third page of this article. The figures offer a measure of relative employment on the six jobs, but they have no specific application, other than as a comparative gage, of the labor which might be required on similar construction in other localities. Every job carries its own set of governing conditions which must be given consideration in estimating costs and bid prices. The following

Contract 5...Concrete and Steel Bridge

Single 50-ft. rolled girder span. To be completed in 150 days.

CONTRACT PRICES

Item	Unit	Quantity		Unit	Amount	
		Estimated	Final		Price	Estimated
Common excavation	Cu. yd.	700	628	\$ 0.50	\$ 350.00	\$ 314.00
Excavation for structure	Cu. yd.	790	813	4.00	3,160.00	3,252.00
Sand gravel fill	Cu. yd.	405	398	1.50	607.50	597.00
Concrete masonry	Cu. yd.	367.8	401.1	21.00	7,723.80	8,423.10
Bar steel reinforcement	Lb.	20,450	20,450	0.045	920.25	920.25
Structural steel	Lb.	72,370	72,305	0.055	3,980.35	3,976.78
Steel forgings	Lb.	860	857	0.15	129.00	128.55
Sheet lead	Lb.	167	166	0.15	25.05	24.90
Zinc plates	Lb.	316	306	0.15	47.40	45.90
Floor drains	Each	8	4	10.00	80.00	40.00
Waterproofing	Sq. ft.	3,400	3,688	0.05	170.00	184.40
Riprap	Cu. yd.	90	90.5	3.00	270.00	271.50
Cement	Bbl.		5	2.33		11.65
					Total	\$17,463.35
						\$18,190.03

MINIMUM WAGES AND HOURS

Skilled labor	\$ 0.65 per hour
Intermediate labor	0.55 " "
Unskilled labor	0.45 " "
Required employment, 10,800 man-hours.	

LABOR COSTS

Classification	Man-Hours	Wages
Executive, administrative, and supervisory	2,587 1/4	\$ 1,667.48
Skilled	1,494 1/4	975.86
Intermediate	699 1/4	391.61
Unskilled	8,311	3,740.34
Total	13,091 1/4	\$ 6,775.29

MATERIAL COSTS

Materials	Quantity	Total Cost
Portland cement, bbl.	827	\$ 1,899.44
Tar products, gal.	250	24.78
Gravel, cu. yd.	228	68.56
Sand, cu. yd.	424	63.62
Freight on above items		752.99
Structural steel, lb.	72,370	2,643.63
Reinforcing steel, lb.	20,590	508.20
Lumber, 1,000 ft. b.m.	10.5	525.00
Motor fuel		349.00
Miscellaneous materials		2,125.06
Total		\$ 8,960.28

paragraphs describe briefly the six contracts listed in the tables.

Contract 1 — Awarded late in the fall with completion specified in 6 months, the contract called for more than 1 1/2 mi. of roadway grading and drainage requiring 43,500 cu.yd. of common and borrow excavation and 800 lin.ft. of culverts. The tables show the equipment used on the job. Roadway grade was 41 ft. wide except for a variable section 145 ft. long where the width increased gradually to 135 ft. at an intersection. Side slopes were 4:1 to natural ground line or for a minimum horizontal distance of 5 ft. to a ditch slope which varied to meet ditch grade. Banks had 2:1 slopes.

Contract 2 — A roadway more than 3 1/4 mi. long of 24-ft. minimum width was covered with a gravel surface 4 in. thick at center line, tapering to a feather edge.

Contract 3 — Practically 2 mi. of 20-ft. concrete was laid on a 45-ft. roadway grade. Existing concrete slab 16 ft. wide on 4,500 ft. of the contract was to be left in place and widened, but a change order caused



CONTRACT 5 involves steel-and-concrete bridge on 33-deg. skew with 42-ft. square opening between abutments.

about 1,000 ft. of this concrete to be removed and replaced. Grading involved 13,000 cu.yd. of common excavation, and draining required 590 lin.ft. of culverts. Quantities of portland cement, stone and sand are listed in the table of material costs for this contract. In the course of constructing the job the contractor purchased \$2,750 new equipment.

Contract 4 — Grading, draining and gravel surfacing of almost 2 mi. of 26-ft. roadway with 3:1 side slopes and special trapezoidal ditch excavation on both sides required 23,000 cu.yd. of common and borrow excavation; 3,700 cu.yd. of gravel, and 700 lin.ft. of culvert pipe. For this work the contractor supplemented his existing plant by the purchase of \$650 additional equipment.

Contract 5 — A steel and concrete bridge on a 33-deg. skew with nine 30-in. 116-lb. beams 50 ft. long carrying a 36-ft. clear roadway across a 42-ft. square opening involved about 45 cu.yd. of concrete in the deck and 350 cu.yd. in the two abutments. The bridge was constructed on a curve in the highway and the girders were set at varied elevations to produce super-elevation of 0.035 ft. per foot in a roadway with a 3 1/4-in. crown.

Contract 6 — A three-span bridge having 24-ft. 7-in. end spans and a 25-ft. 2-in. interior span had a 30-ft. clear concrete roadway resting on eight lines of 18-in. 55-lb. longitudinal girders supported by creosoted timber pile bents. Piles were 45 ft. long, and caps were stepped prior to treating to give the 6-in. reinforced deck slab a 2 1/4-in. crown. Abutments and wing walls were bulkheaded with 3x10-in. creosoted planks. Riprap 1 ft. thick was placed on a 1 1/2:1 slope in front of the abutments and around the wings. The contractor purchased \$200 new equipment during the course of the job.

Contract 6...Timber, Steel and Concrete Bridge

Three 25-ft. rolled girder spans. To be completed in 120 days.

CONTRACT PRICES

Item	Unit	Quantity		Unit	Amount	
		Estimated	Final		Price	Estimated
Excavation for structure	Cu.yd.	100	101	\$ 3.00	\$ 300.00	\$ 303.00
Concrete masonry	Cu.yd.	53	53	24.00	1,272.00	1,272.00
Bar steel reinforcement	Lb.	10,930	10,930	0.04	437.20	437.20
Structural steel	Lb.	51,350	51,263	0.055	2,824.25	2,819.46
Zinc plates	Lb.	76	76	0.20	15.20	15.20
Treated timber piling, delivered	Lin. ft.	1,620	1,700	0.70	1,134.00	1,190.00
Treated timber piling, driven	Lin.ft.	1,380	1,426	0.50	690.00	713.00
Treated lumber and timber	M b. m.	4.38	4.38	120.00	525.60	525.60
Floor drains	Each	12	12	12.50	150.00	150.00
Waterproofing	Sq.ft.	100	100	0.10	10.00	10.00
Riprap	Cu. yd.	200	166	2.50	500.00	415.00
				Total	\$ 7,858.25	\$ 7,850.46



CONTRACT 6 calls for bridge of three 25-ft. spans resting on creosoted timber pile bents with 30-ft. clear concrete roadway deck (on 18-in. I-beam stringers) protected by concrete curb and steel guard rail.

MINIMUM WAGES AND HOURS

Skilled labor	\$ 0.65 per hour
Intermediate labor	0.55 " "
Unskilled labor	0.45 " "
Required employment, 4,200 man-hours.	

LABOR COSTS

Classification	Man-Hours	Wages
Executive, administrative, and supervisory	491	\$ 319.15
Skilled	728 1/2	473.53
Intermediate	219	120.45
Unskilled	3,285 1/2	1,478.53
Total	4,724	\$ 2,391.66

MATERIAL COSTS

Materials	Quantity	Total Cost
Portland cement, bbl.	85	\$ 281.35
Gravel, cu. yd.	44	51.94
Sand, cu. yd.	21	16.17
Structural steel, lb.	51,263	1,609.66
Reinforcing steel, lb.	10,930	344.11
Lumber, 1,000 ft. b.m.	4.384	394.56
Piling, wood, ft.	1,200	835.83
Motor fuel		173.66
Miscellaneous materials		1,200.00
Total		\$ 4,907.28

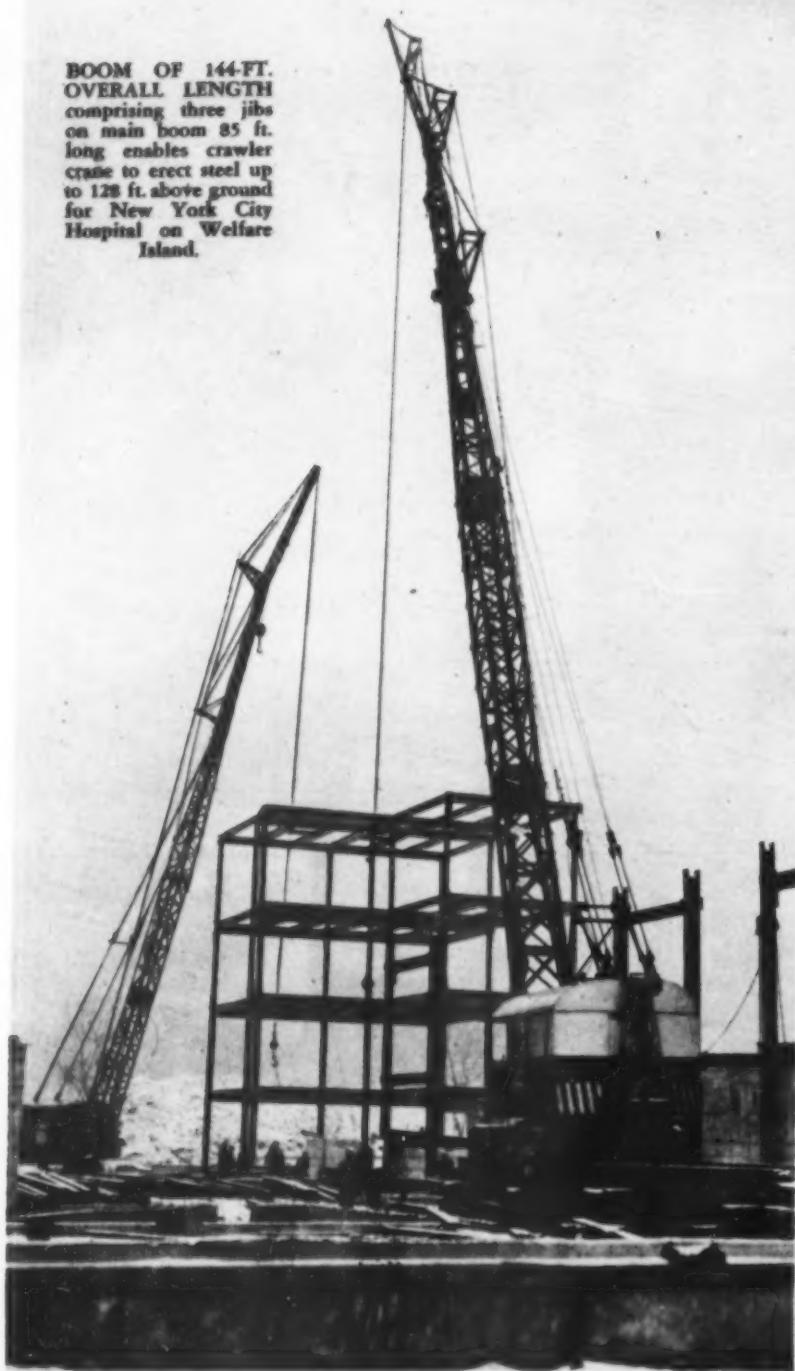


Harlem River Lift Span

of Triborough Bridge, New York City, rests on massive piers more than 50 ft. high, providing shipping clearance of 55 ft. above mean high water when in lower position. When span is raised by hoist motors housed at tops of steel towers, clearance increases to 135 ft. Towers reach total height of 220 ft. above water. Lift span, 310 ft. long and 75½ ft. wide, c. to c. of trusses, weighs more than 2,000 tons and accommodates two 30-ft. roadways separated by an island, providing 20,000 sq.ft. of roadway area, believed to be greatest road area on any lift span yet built. Lightweight welded battendeck floor of $\frac{5}{8}$ -in. structural silicon steel plates is

covered with wearing course of 1-in. mineral-surfaced asphalt plank. Frederick Snare Corp., New York City, built concrete piers on bedrock, and Taylor-Fichter Steel Construction Co., also of New York, erected superstructure, hoisting lift span from barges to pier tops before end panels of 310-ft. trusses were erected. Completed with \$42,000,000 loan and grant from PWA, entire project connecting three boroughs by bridges cost more than \$60,000,000. Triborough Bridge Authority, O. H. Ammann, chief engineer, directed design and construction. Ash-Howard-Needles & Tammen, consulting engineers, designed Harlem River lift bridge.

BOOM OF 144-FT. OVERALL LENGTH comprising three jibs on main boom 85 ft. long enables crawler crane to erect steel up to 128 ft. above ground for New York City Hospital on Welfare Island.



A STEEL ERECTOR'S CRANE of 50-ton rated capacity mounted on crawler tracks and equipped with a boom of 144-ft. overall length set the structural frames of six new buildings up to 128 ft. high on Welfare Island, in the East River, for the Hospital of the City of New York. Built to specifications of the Harris Structural Steel Co., Inc., New York City, contractor, by the Lima Locomotive Works, Inc., Lima, Ohio, the crane is equipped with three hoist drums and with several devices, invented by Thomas A. Foley, master mechanic of the steel company's erection division, to improve its safety and range of operation. These improvements include a multiple-jib assembly, a synchronized counterweight, a folding gantry for the boom hoist hitches (which are moved back to the rear of the crane) and an automatic cutoff to prevent the operator from pulling the boom back over his head. Applications have been made for pat-

ents on the synchronized counterweight and folding gantry.

Long Boom — When equipped with a 50-ft. boom, the crane is able to lift 80 tons. As used on Welfare Island, the machine carried an 85-ft. main boom extended by three jibs to 144 ft. With an 85-ft. boom the crane can pick up 35 tons; after the addition of a 25-ft. jib, its capacity is 25 tons at the 110-ft. point; after adding a second jib, 20 ft. long, the capacity at the 130-ft. point is 8 tons; with a third jib, 14 ft. long, in place, giving the boom a total length of 144 ft., a 2-ton load can be handled. Even with all the jibs in place, the heavier loads still can be lifted at the shorter boom points.

All jibs except the last can be either bolted solid or left hinged for adjustment by means of turnbuckles to which the jib tie-cables are anchored at the base of the boom. When a hinged connection is used the jib can be inclined at any desired angle. By

Synchronized Counterweight

Keeps Crane on Even Keel

holding the 85-ft. main boom practically vertical and boomerang out a three-section jib 59 ft. long at an angle approaching 90 deg., the crane operator can reach across the top of a building of considerable height and width. The jibs are tied back by cables of $\frac{3}{4}$ -, $\frac{7}{8}$ - and 1-in. diameter to turnbuckles of $\frac{7}{8}$ - to $1\frac{1}{4}$ -in. size.

When extended to its maximum length the boom contains 9 tons of Man-ten high-tensile steel. The 144-ft. boom is believed to be the longest ever mounted on a crawler-type crane.

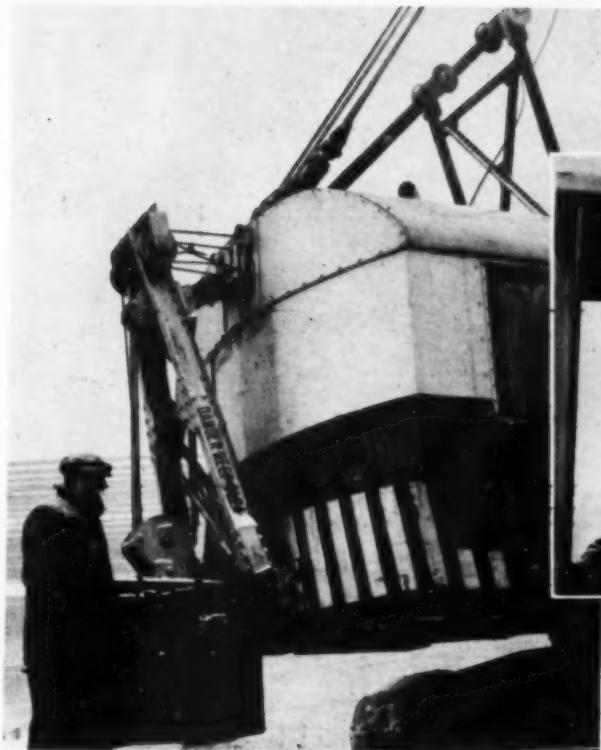
Synchronized Counterweight — At the rear of the crane is hung a counterweight block on a movable boom. Two small drums inside the crane, connected by worm gear and shaft to the boom hoist drive, control the op-

eration of the counterweight boom and load line, synchronizing the movement of the counterweight with the lowering and raising of the main boom in front. During this movement, the counterweight is maintained, by automatic synchronization of its load line, at a constant height above the ground. The height may be set at any desired amount; 6 in. ordinarily is sufficient. This feature, assuring a short drop for the counterweight in case of a broken line or dropped load in the front, prevents overturning of the crane. At Welfare Island, the block weighed 6 tons, but heavier weights have been used on other work.

Folding Gantry — By anchoring the boom hitches behind the gantry on the roof, the crane combines the ad-



SYNCHRONIZED COUNTERBALANCE at rear of crane consists of heavy block suspended from short boom. Two small drums (connected to main boom hoist drive) control operation of rear counterweight, automatically synchronizing its movement with that of main boom. Main boom hitches are anchored behind gantry on roof; gantry comes into play only when main boom is lowered sufficiently.



DETAIL of rear counterweight, operation of which is synchronized with raising and lowering of main boom. Gantry on roof folds down when crane is traveling from one job to another.



AUTOMATIC CUTOFF for boom hoist is actuated by plunger on boom stopper.



IMPROVEMENTS designed to increase crane's efficiency and safety were developed by Thomas A. Foley, master mechanic, Harris Structural Steel Co., Inc. Arrow points to plunger on boom stopper.

vantage of a long hinge angle for a high boom with the use of the gantry for a low boom. The gantry comes into play to support the boom hitch cables when the boom is lowered sufficiently. In 1 min. the gantry can be folded down in contact with the roof for shipping.

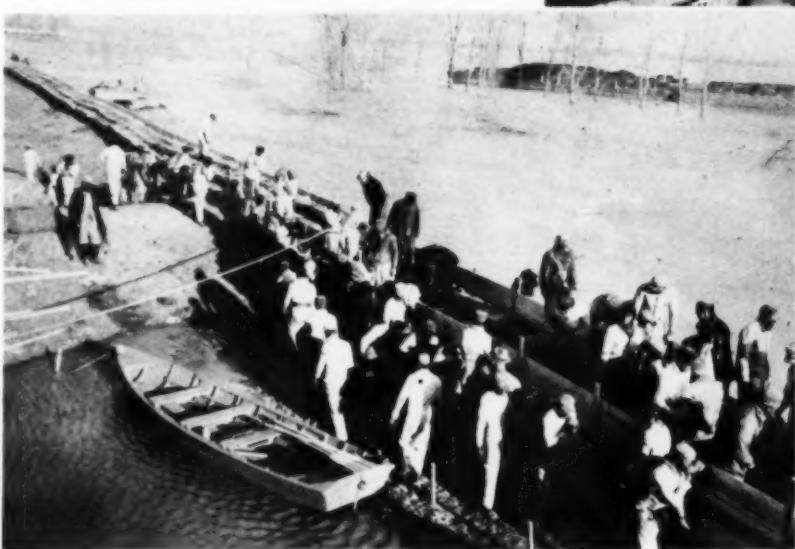
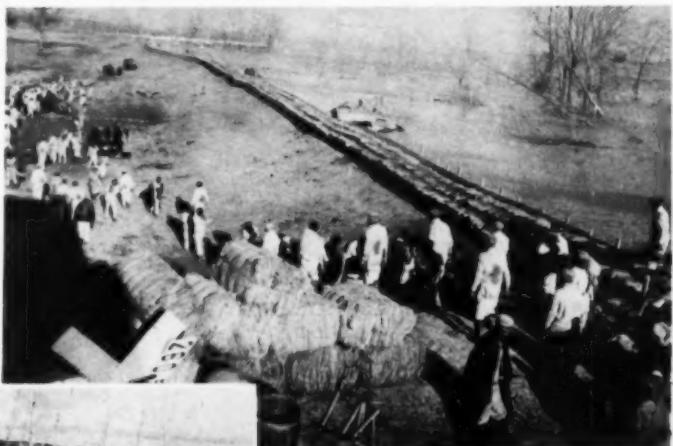
Safety Stopper—An automatic safe-

ty control prevents the crane operator from pulling the boom back over his head. At a high angle the boom comes in contact with a plunger mounted on one of the boom stoppers. The plunger first rings a warning bell; if pushed a little farther it cuts off the crane motor, stopping the boom hoist and preventing backward tipping.

Three Hoist Speeds—Three hoisting drums with which the crane is equipped give the following speeds and pulls: (1) 165 ft. per minute and 26,000-lb. lead line pull; (2) 210 ft. per minute and 20,000-lb. lead line pull; (3) 325 ft. per minute and 10,000-lb. lead line pull. The operator can select the most efficient speed.

Two other crawler-mounted erection cranes at Welfare Island had booms with overall lengths of 90 and 103 ft. These cranes were equipped with boom counterweights operated by hand crabs with which Mr. Foley conducted his experiments leading to the development of the synchronized counterbalance.

Wood-Sheathed Sandbag Parapets Raise Mississippi Levees



RAISED 3½ TO 4½ FT. by sandbagging, levee near Porter Lake, Ark., is made ready for expected superflood in Mississippi River. Convicts behind levee (above) fill sacks shipped to site in bales, as seen in foreground. Sandbag parapet is protected by wooden bulkhead on river side only except for short section of spur levee (left) which is bulkheaded against erosion on both sides.

IN ADDITION to the mudbox type of parapet illustrated on p. 49 of last month's issue (*CONSTRUCTION Methods and Equipment*, March, 1937), many miles of levee on both sides of the Mississippi River were raised against the threat of this year's

Ohio River superflood with piled sandbags protected against wave wash by wooden sheathing. U. S. engineers in the Memphis district raised all levees from the mouth of the Arkansas River to Cairo, Ill., at the mouth of the Ohio, to carry a flow of 62 ft. on the Cairo gage. In general the raising was done by sandbagging, although at some places mudboxes (double wooden bulkheads filled with moist earth) were used. The district purchased more than 7,000,000 bags and 2,000,000 b.ft. of lumber for the work.

Under the 1928 ("Jadwin") plan for Mississippi flood control 554 mi. of a total of 560 mi. of main levees in the Memphis district already had been raised to take care of a 60-ft. flood stage at Cairo, discharging 2,250,000 sec.ft. below Cairo. With a crest discharge of 2,150,000 sec.-ft. expected from the Ohio, the engineers raised all levees to carry a flow 2 ft. above project height on the Cairo gage. To allow for settlement, the levees had been built to excess height, but in many places they had settled below the 62-ft. level or even below the 60-ft. project grade. A force of 15,000 men—CCC, WPA and convict workers—accomplished the raising of a multitude of levee sections in a short time under direction of army engineers.

THE DIESEL ENGINE in Construction Service

By R. L. HAMBLETON

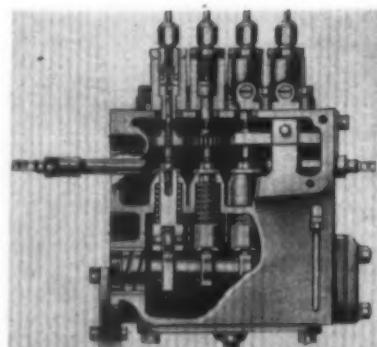
Caterpillar Tractor Co., Peoria, Ill.

ADVENT of the gasoline engine revolutionized fields of power application, such as construction and transportation, which require portable equipment. When an advanced level of gasoline power application had been attained, development was directed toward improvement of operating efficiency — increasing dependability while decreasing running costs.

Diesel Principle—Following the gasoline engine came another engine, the diesel, which was based upon a new and simplified principle of internal combustion. Firing took place by heat of compression, eliminating need of spark plugs, distributor and magneto. Fuel was introduced directly into the cylinders under pressure, dispensing with pre-mixing by carburetor. Of prime importance was the fact that cheap fuel oils in a cruder state than refined gasoline, could be utilized. The diesel principle offered a means of obtaining lower operating costs with an engine of simpler mechanical construction.

High-Speed Diesel—During the 1920's a number of independent industrial organizations undertook the development of a higher speed diesel engine, sufficiently powerful and light in weight to be used in mobile machines. The requirements were quite different from those of the heavy, slow-speed type, in having to compete with the already highly developed and well understood gasoline engine. Development of its diesel engine by the Caterpillar Tractor Co. may be taken as typical in explaining the adaptation of diesel power to modern construction practice.

Light Weight—It was first necessary to decrease the weight per horse-



FUEL INJECTION PUMPS are designed to deliver minute quantities of fuel in varying amounts and at variable speeds.

power—to lighten moving parts for higher operating speeds than had previously been attempted. This purpose required lighter and stronger metals to withstand safely the high combustion pressures of diesel operation.

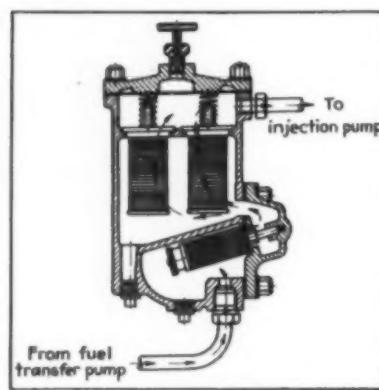
Fast Firing—At the same time, higher speed called for faster firing. This requirement introduced the problem of developing reliable injection equipment to meet such speeds—pumps and valves that would accurately meter and inject minute quantities of fuel with the rapidity and in the varying amounts necessary for both fluctuating load and variable speed operation. Other important necessities included a simple, dependable means for starting, ease of maintenance, ease of handling in actual operation, and widespread distribution of satisfactory diesel fuel.

Fundamental Requirements—Soon after the Caterpillar Tractor Co. started development of a diesel engine for tractors, the following primary requirements were recognized. The engine would have to be capable of filling

definite requirements, under the various field conditions to be encountered and in the hands of unskilled operators. It would have to assure tractor owners of greater economy and at least the same dependability they had experienced with gasoline equipment.

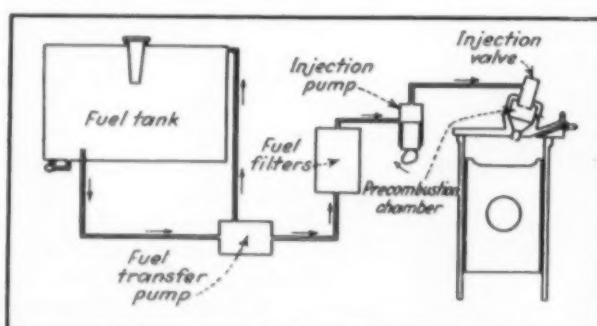
Development proceeded with strict adherence to a plan embracing the following features:

1. Simple and rugged basic design
2. Accessibility of all parts requiring service or replacement
3. A combustion process giving both economical fuel consumption and the necessary operating characteristics for idling, acceleration and variable load demands
4. A positive and simple injection system that would be
 - a. Adaptable to reasonable manufacturing cost
 - b. Precalibrated so that it would require no field adjustment
 - c. Designed so that its important elements would be readily replaceable by an unskilled mechanic

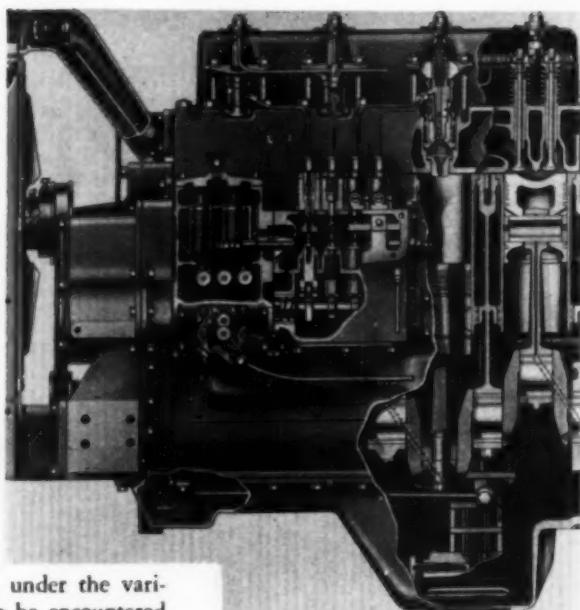


FUEL FILTER UNIT combines three edge-type (lower) filters with 0.0025-in. openings and two wire-wound screen filters with 0.001-in. openings.

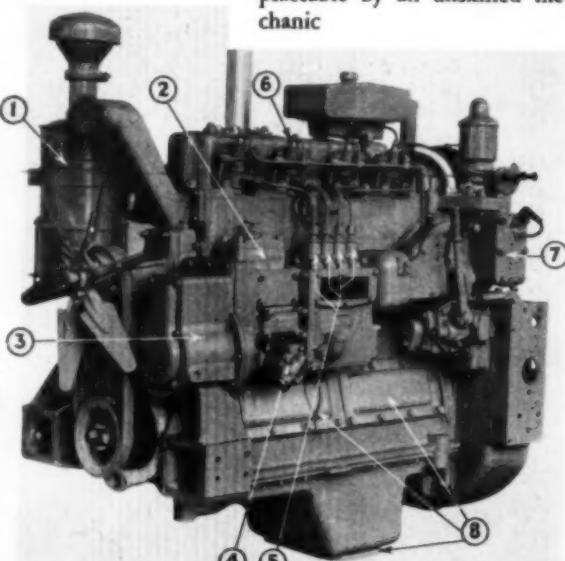
DIAGRAM (below) illustrates stages in fuel-feed system of diesel engine.



TRAVELING UPHILL or downhill lubricating oil pump of tractor engine is designed to assure positive circulation on any grade.



WITH INNER WORKS EXPOSED diesel engine reveals path of fuel to transfer pump (cutaway), to fuel filters (cutaway), to fuel injection pumps (cutaway and with No. 1 pump in section) and to fuel injection valves (with No. 3 valve in section). Crankcase is cutaway to show main and scavenger lubricating oil pumps, crankshaft, connecting rods, pistons and valve mechanism (with No. 4 cylinder in section). Locations of some parts of engine are indicated in numbered photograph at bottom of this page:



FOUR-CYLINDER DIESEL ENGINE of 4 1/4-in. bore and 5 1/2-in. stroke develops maximum of 44 brake hp. and 33 hp. under continuous load. Numbers indicate following parts: (1) large capacity oil-bath air cleaner with pre-cleaner, (2) fuel filter housing, (3) governor, (4) fuel transfer pump supplying fuel at constant pressure to fuel injection pumps, (5) individual fuel injection pumps, (6) fuel injection valve, (7) two-cylinder gasoline starting engine capable of cranking diesel engine for indefinite periods and assuring positive starting even under most unfavorable conditions, (8) large inspection doors.

- d. Capable of being accurately governed for speed and load regulation
- 5. A reliable fuel supply system with filtering units easily accessible and quickly removable for cleaning
- 6. Complete protection from dust
- 7. A simple dependable starting system
- 8. An overall design adapted to modern large production methods that would give the purchaser lowest possible prices for engine and replacement parts.

Experience has demonstrated the wisdom of insisting on these basic features. Anyone purchasing a diesel engine today should be sure that it incorporates these fundamental characteristics.

Mounting an engine in a portable construction machine precludes the use of a rigid foundation. The engine design, therefore, must provide sufficient weight and rigidity to maintain alignment and at the same time be light enough for portable use. Furthermore, the engine must function properly at all angles, because it frequently is tilted both endways and sideways.

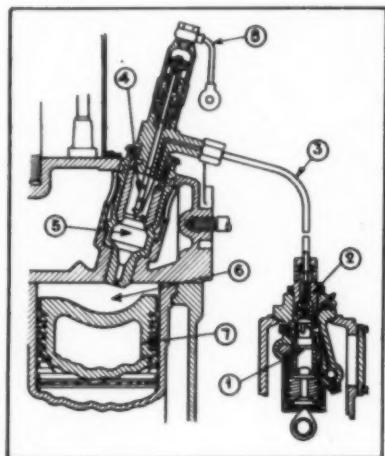
Production Aids—Development of better materials has made it possible to reduce the engine weight to a satisfactory point and still safely withstand stresses imposed by high pressures within the cylinders. Similarly, by special precision tools and methods, injection equipment can now be made to the required accuracy at reasonable cost. Refinements in combustion control today provide better idling and partial load characteristics.

Construction Service—Engines for construction use are subjected to wide and frequent load variations. Consider, for example, a shovel on an excavation job. The engine is running at high idle and, as the bucket digs in, the governor opens up the fuel pumps for the increasing load. When the bucket is partially filled, the boom starts to

swing, putting maximum load on the engine. Instantaneous response to the load is required to prevent stalling. As the loaded bucket is swung and dumped, the load on the engine drops. Sensitive governing with quick acceleration or deceleration is therefore essential for construction service. Inherent torque characteristics of the diesel engine provide good "lugging" ability at low engine speeds.

Fuel Savings—Inasmuch as the fuel consumption of the diesel engine is approximately proportional to the imposed load, it follows that on intermittent loads consumption is much less than that of a gasoline engine. This conclusion is borne out in practice by authentic records on the operation of thousands of diesel engines in service. These records indicate that the diesel engine consumes about one-half as many gallons of fuel as the equivalent gasoline engine on the same job. As fuel oil ordinarily costs about one-half as much as gasoline, the results show diesel fuel expenditure to be about one-fourth that of gasoline. Under certain conditions fuel savings as high as 88 per cent have been reported.

What this fuel saving has meant to contractors may be illustrated by a typical example of an earth-moving job. An Arkansas contractor recently replaced a 60-hp. gasoline tractor with a diesel tractor of the same make. The price of the diesel tractor was only 16 per cent more than the gasoline machine—\$4,650 as compared with \$4,000. The engine in the diesel trac-



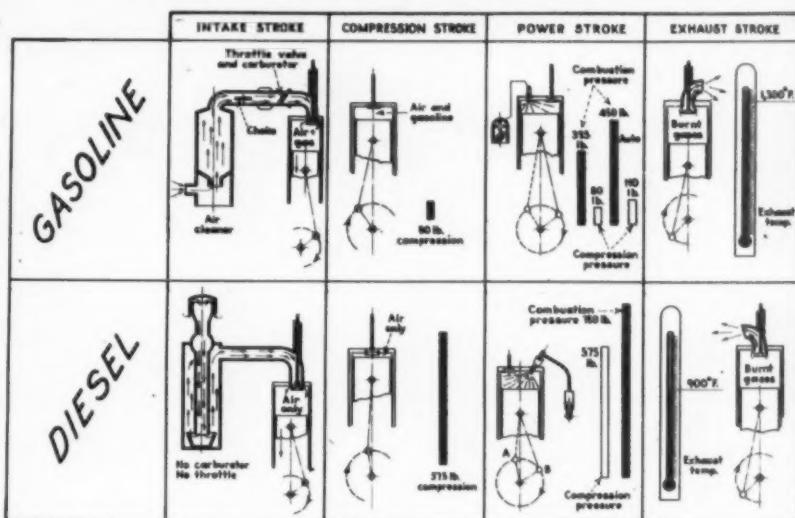
INJECTION AND COMBUSTION SYSTEM includes: (1) injection pump, (2) check valve, (3) injection line of heavy walled steel tubing, (4) injection valve with single hole, (5) precombustion chamber to assure good idling and variable load operation, (6) combustion chamber, (7) aluminum piston, (8) leakage drain.

tor was a four-cylinder, four-stroke cycle, 80-hp. unit, weighing 4,550 lb. Both tractors handled the same load—6 yd. pay load of earth in track-type dump wagons. The cost of gasoline was 14c. per gallon, against 5c. per gallon for diesel oil.

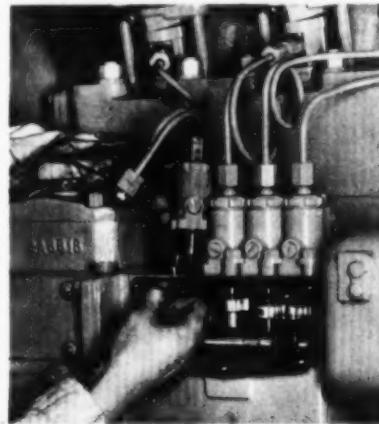
	<i>Gasoline Tractor</i>	<i>Diesel Tractor</i>
Fuel cost per hour	\$0.84	\$0.15
Gasoline—6 gal. per hr. at 14c.		
Diesel oil—3 gal. per hr. at 5c.		
Average number trips per hour	10.5	12
Fuel cost per cubic yard	0.0133	0.002
Saving per cubic yard		0.011
Saving per hour		0.69
Saving per 8-hr. day		5.52
Saving per 5,000 hr.		\$3450.00

Lubrication—Lubricating oil for the diesel engine costs slightly more than for the gasoline engine because

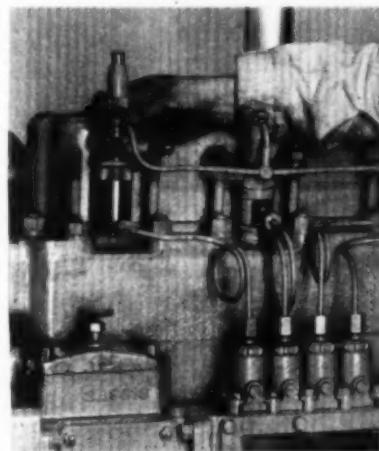
GASOLINE AND DIESEL ENGINE CYCLES



DIAGRAMMATIC COMPARISON of gasoline and diesel engine cycles shows high compression pressures of diesel engine required to generate heat of combustion, which takes place without aid of electric spark. Combustion pressures likewise are higher for diesel engine, and temperature of exhaust gases is lower.



NO FIELD ADJUSTMENTS are required in replacing fuel injection pump, as these pumps are pre-calibrated to make them completely interchangeable.



FUEL INJECTION VALVES likewise are interchangeable and can be replaced without field adjustment.

a superior quality is needed. Piston, ring and cylinder replacements, especially those which might be considered premature, are ordinarily the result of stuck piston rings—a condition which causes loss of compression, loss of power, blowby, and overheating and scoring of piston, rings and cylinder walls. Stuck rings can be prevented by the use of proper lubricating oils. Improper oils allow carbon to be caught in sticky resins, and eventually a mixture is formed with sufficient strength to lock the rings in the grooves and destroy their function.

Recent improvements have been made in lubricating oils by the addition of ingredients to hold the resins in solution. Extensive tests and practical service have shown a clearing up of the "stuck ring" difficulty. The improved oils supply the answer to most diesel engine operating troubles.

Maintenance and Repairs—Maintenance costs for the diesel engine are comparable with those for the equivalent gasoline engine doing the same kind of work and receiving the same care and attention. Under these conditions the diesel engine may be expected to have as long a useful life as the

gasoline engine, or possibly even longer.

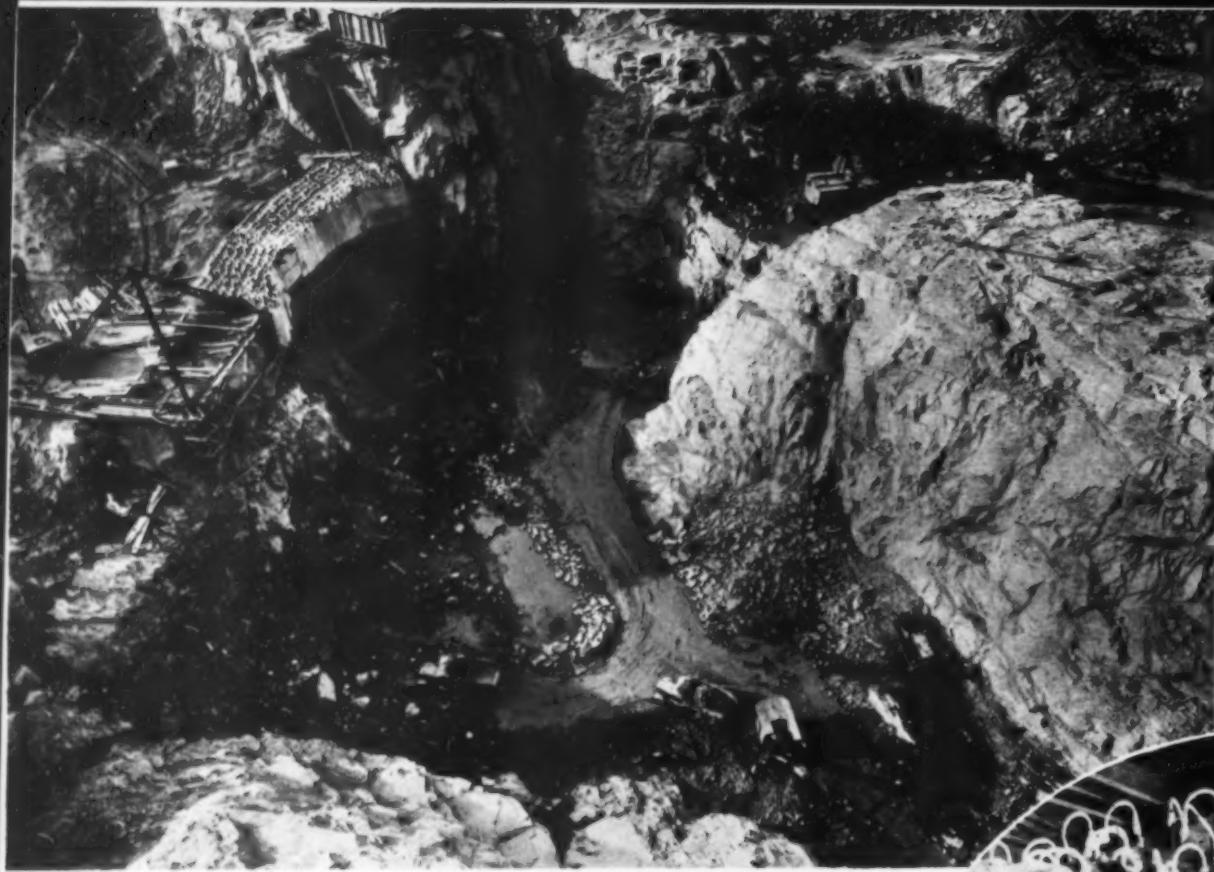
Availability of replacement parts is essential, especially for key units on a construction project. Injection pumps and injection valves, pistons, rings and cylinder liners are the items most likely to need replacement. It is impossible even to approximate the number of operating hours to be expected before any such replacement becomes necessary, as this period depends upon the conditions surrounding each individual installation. A complete set of all the above parts for a Caterpillar 4 1/4-in. bore engine costs at present about \$40 per cylinder.

Clean Fuel Important—Practically the only reason for replacing injection equipment is the loss of effectiveness caused by wear of the closely fitted parts. This wear is due almost entirely to abrasives in the fuel. If it were possible to obtain a fuel absolutely free of solid abrasive matter, it is probable that the injection equipment would last as long as the engine.

Through the cooperation of leading oil companies with diesel engine manufacturers, a cleaner and better performing fuel is now more universally available. In addition, a vigorous campaign is being carried on, urging the careful handling of fuel to prevent its contamination between refinery and engine fuel tank. Among other things the campaign urges the use of 500-gal. or larger fuel storage at the site of the work. By allowing it to settle for 48 hr. fuel is greatly cleared.

Fuel Prices—Prices of distillate fuel for diesel engines vary with localities and with the quantities purchased. The general price level has remained fairly constant for many years and is expected to continue so.

Fortunately, the same fuel is used in burners for domestic and other types of heating installations, and this condition has helped to stabilize the demand and price.



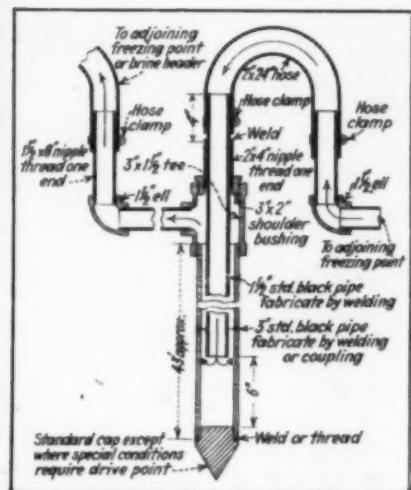
ARCH OF FROZEN EARTH closing portal of narrow rock gulch at left restrains huge flow of silt from burying east excavation area at Grand Coulee dam, where equipment can be seen removing remnants of slide which covered foundation rock before ice dam was put in service.

Frozen Earth Stops a Slide at Grand Coulee

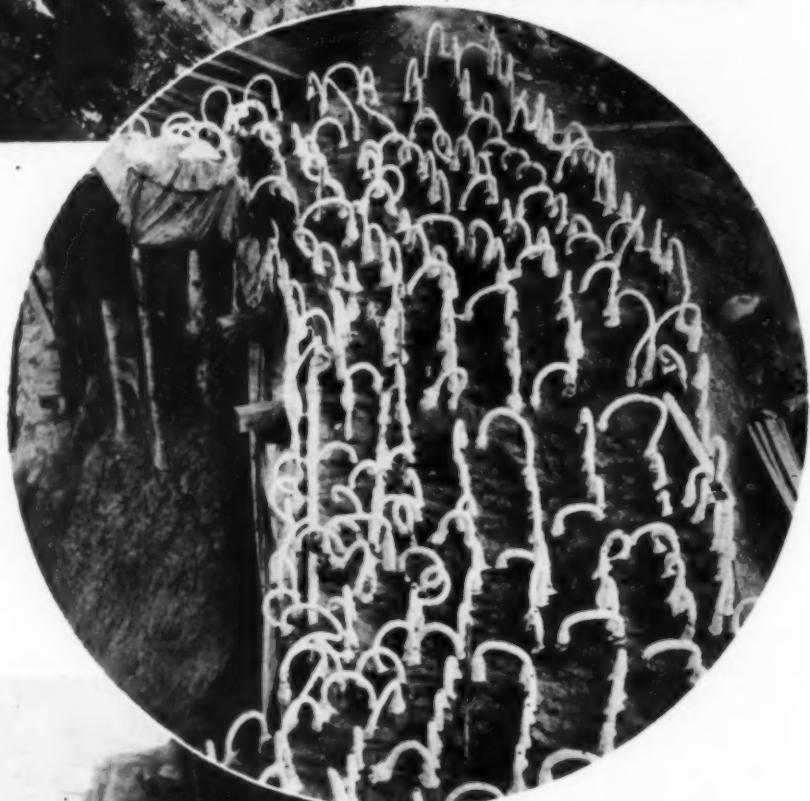
AT A TOTAL COST of \$30,000 the U. S. Bureau of Reclamation froze an arch dam of moist glacial silt 100 ft. long 20 ft. thick and 40 ft. high to stop a slide of 200,000 cu.yd. of ultra fine rock silt flowing through a narrow rock gulch into the center of the east excavation area at Grand Coulee dam.

A total of 377 freezing points carrying brine solution lowered the temperature of the material, which contained an average of 32 per cent moisture by dry weight, at a uniform rate. The ammonia-brine refrigerating system included two used ammonia compressors with a combined capacity of 80 tons of ice per day. The frozen earth arch was decided upon after the slide had buried a concrete and rock-filled timber crib dam which then was utilized as a base for the frozen arch. The Mason-Walsh-Atkinson-Kier Co. is contractor for Grand Coulee dam.

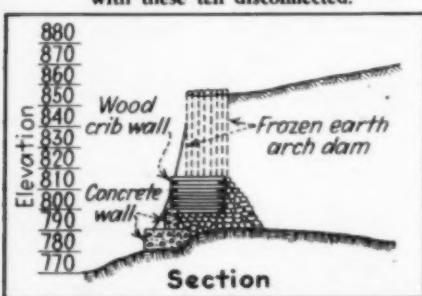
FROZEN SECURITY (right) in form of ice dam high above their heads permits men to work with ease and confidence while stripping bedrock in east forebay area. After excavation has uncovered timber crib wall, portion of which can be seen, cribbing passes seepage from slide behind frozen arch, eliminating need for sump and pump used to remove drainage up to this time.



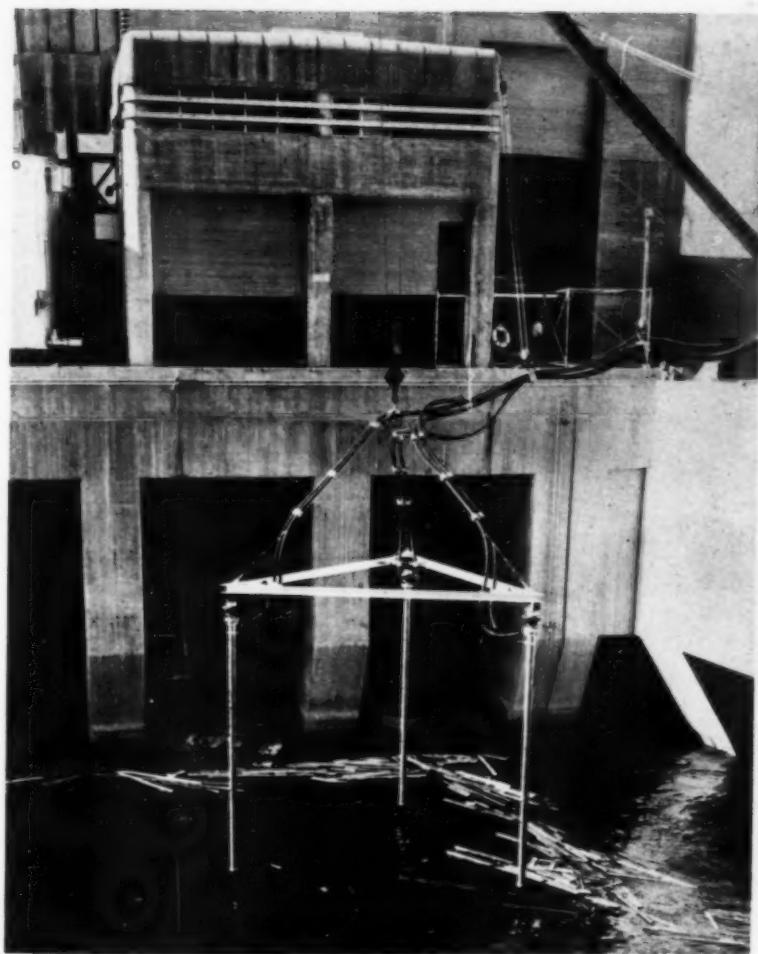
FREEZING POINT consists of 1 1/2-in. inner pipe and 3-in. outer pipe. Brine is forced down 1 1/2-in. pipe, is returned through annular space between pipes, and emerges at tee.



FROSTED HORSESHOES of 2-in. hose mark connections between freezing points in brine system. Points are arranged in eight parallel rows and are spaced 30 in. c. to c. in two directions, with 25 extra points in each abutment. Sixteen points are connected in each group between 3-in. supply headers, with valves in headers to regulate flow and maintain uniform freezing among groups. Expansion of dam during freezing bends freezing pipes and breaks ten at couplings, but freezing continues successfully with these ten disconnected.



DAM TO STOP SLIDE comprises frozen arch 40 ft. high on top of concrete and timber crib structure about 35 ft. high.



GIANT WATER HEATER

(left) dissipates energy developed during tests of 115,000-hp. generators installed by U. S. Bureau of Reclamation at Boulder dam. Three-pole rheostat, designed to take potentials up to 18,600 volts, conducts current of three-phase cycle into water of power-house tailrace, which furnishes resistance required to absorb it. Resistance increases as poles are lowered deeper into water, affording opportunity to observe behavior of generator under varying loads. Prior to tests water was analyzed to determine conducting properties and resistance. Fish swimming into field of rheostat are apparently electrocuted and float to surface, but, as soon as current is turned off or they float out of charged field, they revive and swim away.



Wide World Photo

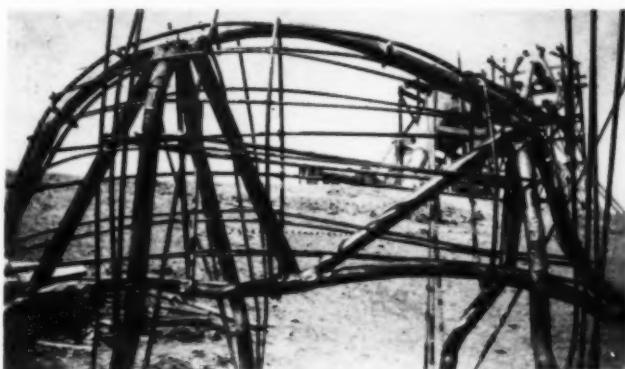
STEPPED TO CONQUER

threat of glass breakage by hailstones, new St. Louis municipal conservatory utilizes setback solid roof construction supported by main frame of elliptical arches. All exterior metal is copper, eliminating need for painting. Building has outside plan dimensions of 186x55 ft. and height of 55 ft. Total glass area of 16,654 sq. ft. comprises 4,000 24x26-in. panes. Design was adopted after studies of unglazed model of building showed light average of 42.9 per cent inside structure throughout complete annual cycle of sun.

JOB ODDITIES

A MONTHLY PAGE OF

Unusual Features of
Construction



WELDED DINOSAURS,

with skeleton frames of 2-in. pipe built up with aid of oxy-acetylene torch (above) and covered with concrete-on-metal lath hides, add realism to prehistoric memorial park in Black Hills of South Dakota. Tyrannosaurus rex, grinning reptile crouching on his concrete pedestal, (right) measures 45 ft. from head to tip of tail.



LICENSED AS A BOAT,

four-wheeled amphibian traverses Louisiana swamps for Gulf Oil Corp., carrying 1,000-lb. load of geophysicists and surveyors on tires 10 ft. in diameter and 33½ in. wide. Hollow wheels of sheet aluminum 5½ ft. in diameter can keep 7,500-lb. vehicle and passengers afloat with all tires deflated. In case of puncture, compressor attached to engine can maintain pressure in tire until marsh buggy returns to base. Detachable tread links of inflated water hose provide traction in marshes and water. Features: V-8 motor, four-wheel drive, rocker-type front axle, differential action between wheels on opposite sides of vehicle, separate braking action to stop wheels on one side only when desired. Two transmissions in series give ten forward speeds and six reverse. Maximum speeds, 35 m.p.h. on land and 6 knots in water. Overall length, 22½ ft.; clearance, 4 ft.; draft, loaded, less than 2 ft.



Photo, Aluminum Co. of America



RESCUE WORKER

is equipped to answer call for help against gas from section of Chicago Sanitary District's 72-mi. of sewer tunnel being completed with aid of \$58,000,000 PWA allotment.

Getting Down to DETAILS

*Close-Up Shots
of Job Methods
and Equipment*

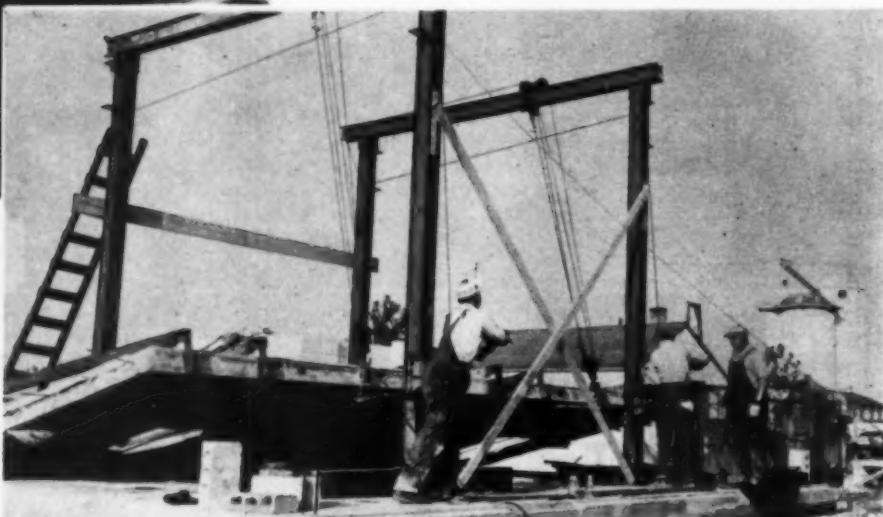


MOVABLE PONTOON BRIDGE

crossing auxiliary lock at Dam 21, Quincy, Ill., of 9-ft. canalization of Upper Mississippi River serves McCarthy Improvement Co., of Davenport, Iowa, in building dam at this point under \$2,422,132 contract. Pontoon portion of construction bridge is made movable to allow river traffic to pass through auxiliary lock when high water produces too great velocity of flow through main lock, at right. Approach spans to pontoon portion can be raised or lowered by cable slings to compensate for changes in water level.

TO LINE UP PIPE

(left) for tack-welding at joint, workers on natural gas line in Southeast use lever-and-fulcrum device that fits on top of one length of pipe and reaches over to raise next length into position for welding. Device, known as "grasshopper", was fabricated of 2-in. pipe by welding. —Photo from LINDE AIR PRODUCTS CO.



MONOLITHIC WALL PANEL

for concrete house construction is cast in horizontal mold handled by trolley sheave hoists on steel gantries. Electrical conduits, plumbing pipes, and heating and air-conditioning ducts are set in place before concrete panel is cast.



SHALLOW GRADING

to depths of less 2 ft. with tolerance of only 0.1 ft. at U. S. Waterways Experiment Station, Vickburg, Miss., is accomplished by three front-end loaders hooked to single drawbar on 35-hp. tractor. Scrappers are making cut for foundations of scale models of Mississippi River. —Photo from HORACE T. LONG, associate engineer, chief of operations section, U. S. Waterways Experiment Station, Vickburg, Miss.



EARTH TRAP

delivers spoil from 18-cu.yd. pneumatic-tired scraper drawn by 95-hp. diesel tractor to new-model 10-yd. earth-moving truck powered by diesel engine.



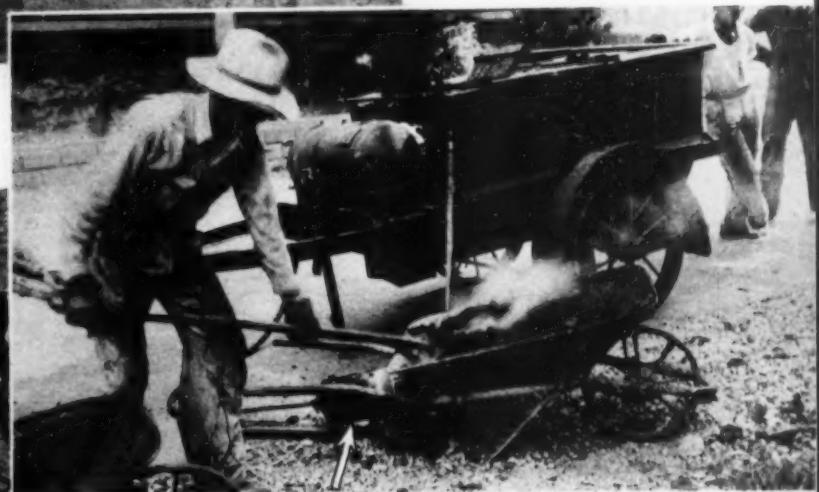
PAIR OF DRUM RADIATORS

in circulating steam system designed to heat concrete aggregates is erected above each gate of timber tunnel through which materials pass to cars serving mixing plant at portal of Mono Craters tunnel, under construction by City of Los Angeles 345 mi. north of the city at elevation of almost 8,000 ft. By means of these radiators aggregates in vicinity of gates are thoroughly warmed before they drop into cars in tunnel. Structures over gates were built up with welding torch of material taken largely from city's storage yard.



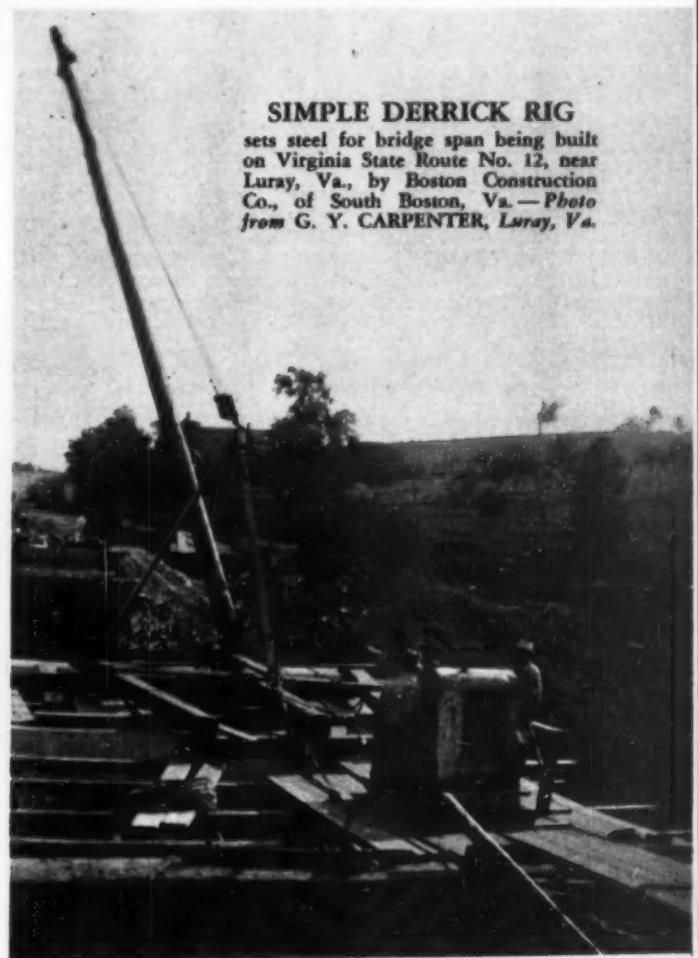
AIR-OPERATED CLAMSHELL BUCKET

developed and built in shop of Potomac Electric Power Co., Washington, D. C., utilizes air pressure available from truck-mounted compressor to dig manholes up to 20 ft. deep, although normal depth is 9.3 ft. Bucket, of 3-cu.ft. capacity, is not heavy enough to dig hard packed earth without first loosening with air spades. Boom lifts bucket high enough to load truck directly if desired, although spoil usually is piled temporarily on street. After hole has been dug to 5-ft. depth, bucket raises spoil over 10-ft. sheeting which is then set in hole, eliminating rehandling.—Photo from HARWOOD E. READ, Potomac Electric Power Co., Washington, D. C.



IMPROVISED HEATER

prepares Kentucky rock asphalt for pavement patching. Oil burner placed under tray of metal wheelbarrow is crude but effective way, if carefully done, of heating small quantity of material for surface maintenance work.



SIMPLE DERRICK RIG

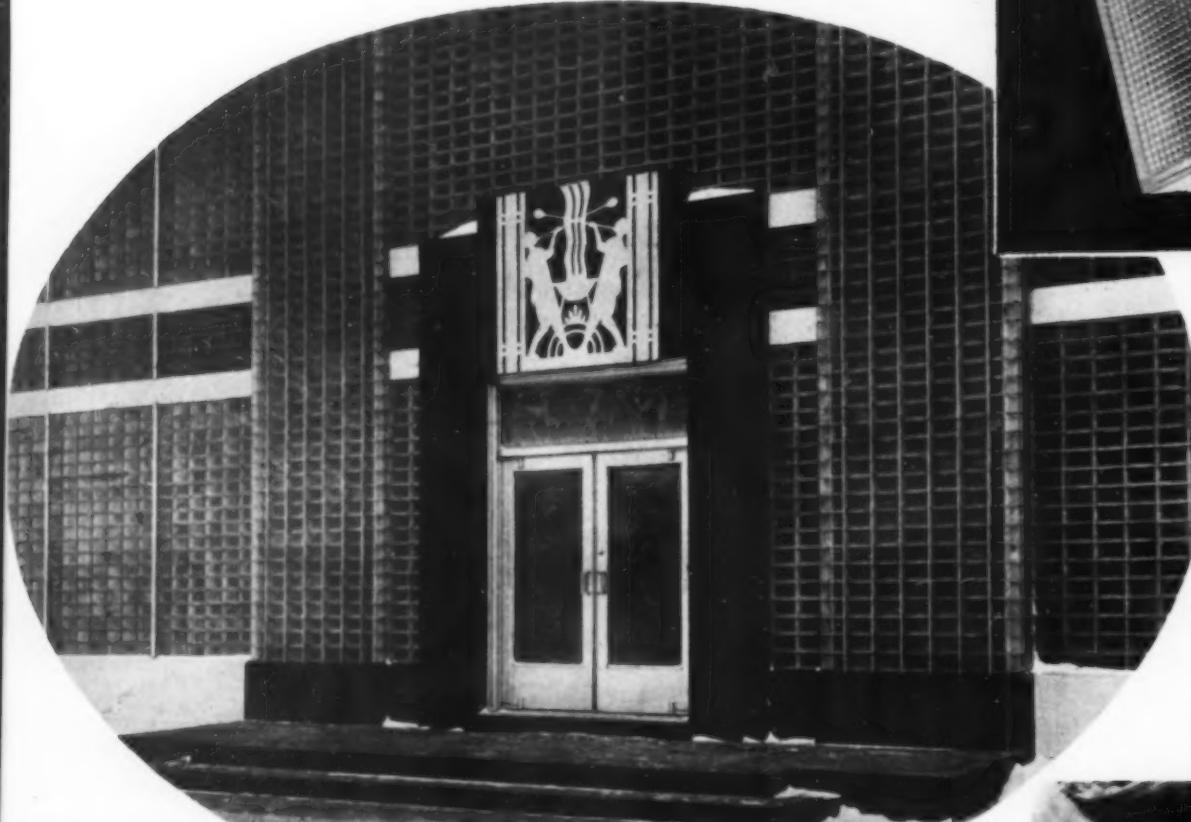
sets steel for bridge span being built on Virginia State Route No. 12, near Luray, Va., by Boston Construction Co., of South Boston, Va.—Photo from G. Y. CARPENTER, Luray, Va.

WANTED — Photos of Details

The Editor of CONSTRUCTION Methods and Equipment wants photographs or sketches illustrating interesting DETAILS of method or equipment and will pay for those he finds acceptable for publication.

Hasn't your job produced some DETAIL that might be illustrated on this page? Send along a picture of it; we'll return it promptly if we can't use it.

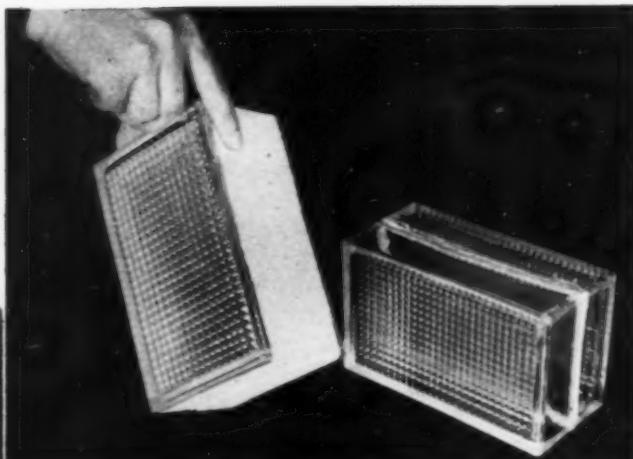
Glass Masonry Walls Admit Diffused Daylight



EXTERIOR WALLS of glass masonry blocks as exemplified at entrance to Owens-Illinois packaging research laboratory, Toledo, Ohio, offer possibilities for interesting architectural treatment.

and partitions. Glass blocks developed by the Owens-Illinois organization and manufactured at its Muncie, Ind., plant were used.

Manufacture — Each glass block is made by pressing a five-sided rectangular unit and a lid, which is hermetically sealed to provide an air-tight cavity, partially evacuated, within the



ENAMELING AND SANDING of glass blocks adds to adhesive quality, by which mortar is bonded more effectively to prevent water leakage and increase wall strength against lateral pressure of wind. Finger points to enameled side of block which fits against mortar. Block at right has not received enamel coating.

block. Blocks in the exterior walls are $4\frac{1}{8}$ in. high, 8 in. wide, and $3\frac{1}{8}$ in. deep, and they weigh 4 lb. each. For interior partitions blocks $5\frac{1}{4} \times 5\frac{3}{4} \times 3\frac{1}{8}$ in. were used; each of these blocks weighed about $3\frac{1}{4}$ lb. For bonding purposes, the block is treated on the top, bottom and two ends with a special enamel while it is still warm, after coming out of the oven, and



WHEN MORTAR REACHES INITIAL SET, joints are rubbed vigorously with round, pointed rod to seal joint surface and prevent leakage.

later is given a second coating of enamel which resists water, acids and alkalies, prior to the application of white sand. The rough finished surface provides a strong mortar bond to prevent water seepage and increase wall strength against wind pressure.

Physical Properties — Water-clear glass blocks used in the Toledo laboratory building transmit 86.5 per cent of the light falling upon them, but the glass company offers blocks with a variety of face cuttings which reduce light transmission to as low as 11.7 per cent. Compression tests have shown the blocks capable of taking an ultimate pressure of 2,000 lb. per square inch, almost three times the strength

MORTAR OF PROPER CONSISTENCY is applied to glass block with trowel. Sticky, plastic mortar is essential in setting glass blocks.

A TWO-STORY BUILDING of 39 rooms with an aggregate floor area of 20,000 sq. ft. housing the offices, laboratories and shops of the Owens-Illinois Glass Co.'s packaging research unit at Toledo, Ohio, has exterior walls and partitions 4 in. thick constructed entirely of glass blocks laid up in cement mortar by brick masons. The glass-block walls are translucent but not transparent; they admit a diffused light which is free of shadows. A total of 80,000 blocks was required for a surface area of about 20,000 sq. ft. in the walls



required for wall masonry units by the most exacting building codes. The blocks resist fire and deaden sound.

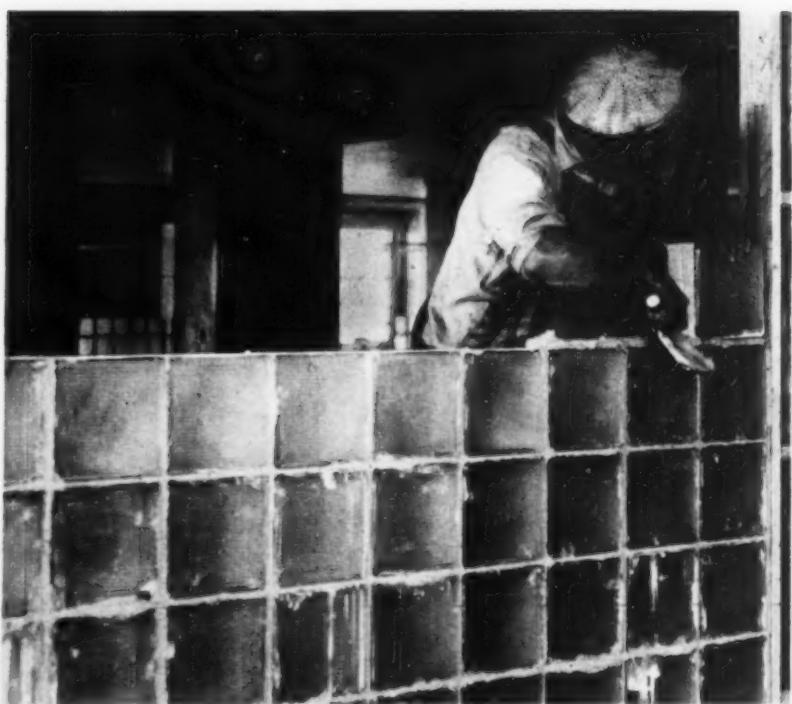
Glass block walls 4 in. thick have approximately the insulating value of a 4-in. wall of common brick. Heat transmission is only about one-half as great as through single-glazed steel sash. Condensation on the inside of a 4-in. glass-block wall is practically eliminated; tests produced no "sweating" when the outside temperature was 16 deg. below zero, F., and the inside temperature was 70 deg., with a relative humidity of 40 per cent on the

inside. Expansion and contraction of the glass units resulting from changes in temperature correspond very closely with those of mortar and steel, the materials with which the blocks are used.

Laying Blocks—Thorough annealing makes the blocks reasonably tough. Not one block of the 80,000 used in the laboratory building was broken. The manufacturer's experience has shown that a good mason can lay 500 of the double-standard-size blocks per day, tool-finished and wiped on both sides, which is equal to 1,000 standard clay



DIFFUSED DAYLIGHT admitted through glass masonry walls eliminates strong lights and shadows and reduces eye strain for designers and machinists.



INTERIOR PARTITION is laid up in mortar with structural glass blocks $5\frac{1}{4}$ in. square and $3\frac{1}{8}$ in. thick.

bricks—considered a good day's work if the mason strikes the joints.

All blocks should be laid with full joints in mortar of first-class workability. To produce water-tight walls, blocks must not be disturbed after they have been laid. Excess mortar is cleaned from the blocks with a rough cloth or steel wool immediately after the blocks are laid, before the mortar

becomes dry and hard. When the mortar reaches its initial set, the joints are tooled by vigorous rubbing with a round, curved rod to smooth and seal the surface of the mortar.

Cost—According to the manufacturer, glass blocks are lower in cost than other types of glass masonry construction and compare in price with glazed steel sash of average quality.

Gravel-Filled Timber-Box Drain

Intercepts Groundwater Outside Foundation Walls



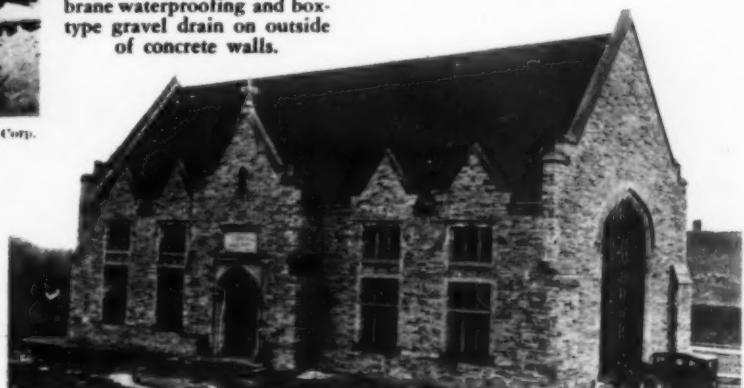
Photos, Wood Preserving Corp.

AS A MEANS of protecting, and relieving groundwater pressure on, damp-proofed foundation walls of the Ashburton pumping station of the Baltimore, Md., water supply system, the city's Bureau of Water Supply, Leon Small, chief engineer, surrounded the concrete structure be-

low ground level with a continuous gravel-filled wooden box, utilizing creosoted oak for permanence instead of the untreated lumber which had been incorporated in similar drains in the past. The pumping station has machinery pits extending almost 20 ft. below grade. Ground-water level rises in-

VERTICAL BOX DRAIN (left) consisting of gravel-filled pockets between two lines of creosoted oak sheathing conducts intercepted seepage to tile drain at footing level, relieving groundwater pressure on damp-proofed concrete wall.

ASHBURTON PUMPING STATION (below) of Baltimore water supply, measuring about 100x71 ft. in plan, has machinery pits maintained in dry condition by combination of five-ply membrane waterproofing and box-type gravel drain on outside of concrete walls.



HEAVY CONSTRUCTION

Principles and Practices of Job Layout and Selection and Use of Equipment for Large Dams and Appurtenant Works

By ADOLPH J. ACKERMAN and CHARLES H. LOCHER

Construction Plant Engineer

Construction Consultant

TENNESSEE-VALLEY AUTHORITY, KNOXVILLE, TENN.

16 . . . Special Types of Transporting Equipment

RAILROAD TRAINS — The current trend has been away from locomotives and trains for general hauling of excavated materials around the usual construction job. Expensive roadbeds, limitations in grade and the constant shifting of track tend to make railroad haulage uneconomical as compared to other types of equipment, except in stabilized situations such as delivery from a gravel pit, aggregate plant, mixing plant, or quarry, where the distance is long or where both loading and dumping occur at fixed positions. For such fixed or long-distance operations, however, there is no equipment that can handle and transport materials as cheaply as the railroad.

The handling of 50,000,000 tons of gravel for the Fort Peck Dam over a distance of 12.2 mi. was obviously a railroad job for which standard-gage service was used. At Norris Dam the delivery of concrete from mixers to cableway by means of 6-yd. special dump cars, was done by railroad, the hauling distance being from 250 to 750 ft. For such services, the railroad has special advantages of speed and continuity of service. A careful system of dispatching and traffic regulation is essential to best performance. The attention to safety measures is

particularly important for railroad work because of the inability to control the equipment under emergency conditions as readily as can be done with smaller individual hauling units.

The size and type of cars to be employed on a job depend on local conditions and the nature of the material. Aside from regular full-sized railroad equipment, standard gage (56 1/2 in.) construction cars are available in sizes of 10, 12, 20, 25, 30, 35 and 50 cu.yd. (water level measurement). They are usually of the side-dumping type with either drop-doors or rising sides. The bottom of the car tips to an angle of 45 to 50 deg. either way. The drop-door dumps farther away from the track as the material slides out and over the door, but this feature

requires more maintenance than the rising sides. The dumping is usually done through air controls which may be located at the locomotive or on the cars where a separate operator can control the dumping. A 30-yd. air dump standard gage car costs about \$4,600. A similar car of a 20-yd. capacity costs about \$3,600 and a 12-yd. car, about \$2,200.

In the narrow gage range, the 3-, 4-, and 5-yd. single truck and the 8-yd. double truck sizes run on 36-in. gage. There is also the 2-yd. size running on 30-in. gage and a 1 1/2-yd. size running on 24-in. gage. The dumping operation is usually manual for these sizes.

Selection of Locomotives — Locomotives are rated in terms of their actual weight, because for a given train of loaded cars, a locomotive of certain weight is required which will develop enough friction on the rails to get the

train in motion. This friction is called "tractive effort" and is equal to the weight of the locomotive on the drive wheels multiplied by the coefficient of friction which runs from .18 to .25 for steel tires running on normal dry clean rails. The maximum tractive effort occurs when the driving wheels slip, and the drawbar pull required on a given train to set it in motion must, of necessity, be less than the maximum tractive effort of the locomotive — otherwise the wheels on the driver will slip. The condition of rails and railbed have an important effect on locomotive performance, and grades and curves should be kept at a minimum. For steep grades, the power of the standard type of locomotive is insufficient and a special geared type of heavy-duty locomotive is employed.

The following process is a step-by-step method of selecting a locomotive:

First, the production requirements are determined, together with the number of cars required per train, the weight of material hauled, and the weight of the cars. The drawbar pull required to move the entire system forward is determined in the following manner:

The drawbar pull necessary to start a train and maintain it in motion on straight, level track is 20 lb. per ton of train weight, exclusive of locomotive weight. The drawbar pull necessary to overcome gravity on grade is 20 lb. per ton of train weight exclusive of locomotive weight per each 1 per cent grade or fraction thereof.



Fig. 1 . . . CABLEWAY DRAG SCRAPER moves earth into embankment for railroad bridge approach.



Fig. 2 . . . CHAMBERS BRIDGE carrying 10-yd. car is loaded by walking dragline with 80-ft. boom, 8-yd. bucket.

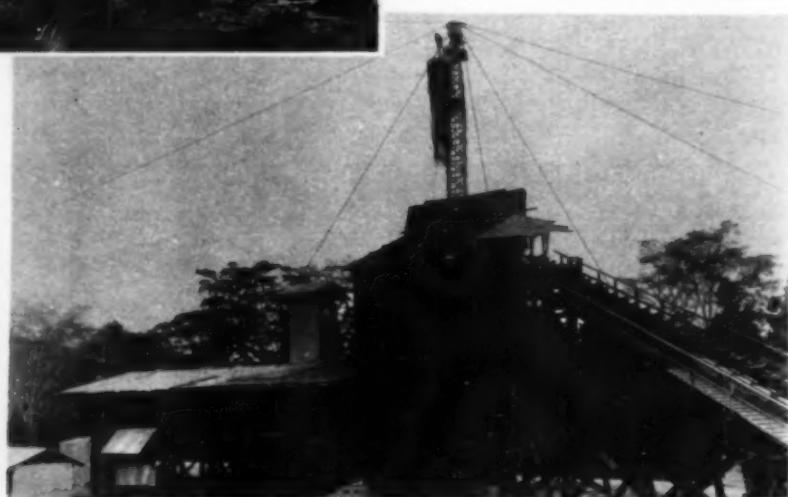


Fig. 3 . . . LOADING TERMINAL charges 32-cu.ft. buckets of tramway used in transporting gravel from pit 1 mi. to screening plant at Madden Dam.



Fig. 4 . . . GRAVEL-TRANSPORTING TRAMWAY (left) at Madden Dam carries 225 yd. per hour between terminals 1 mi. apart.

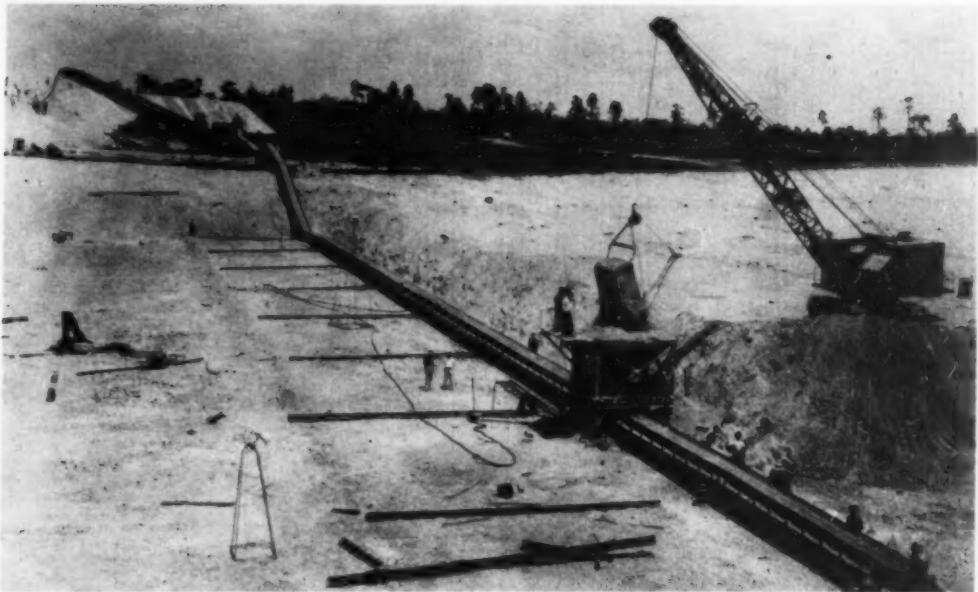


Fig. 5 . . . MOBILE BELT CONVEYOR SYSTEM transports excavated earth to disposal banks on Florida Ship Canal.

The drawbar pull necessary to negotiate a curve is 0.8 lb. per ton of train weight inclusive of locomotive weight for each degree of track curvature. By using the three foregoing principles in the proper combinations and adding up the total drawbar pull, the required weight of locomotive, in tons, is obtained by multiplying the drawbar pull in tons, by 4. With the foregoing information, as a start toward selecting the required size of locomotive, it is now necessary to analyze the speed considerations to fit the job, also the rate of acceleration, the need for high starting power, and the distance and rate of travel in both directions. The accompanying table gives representative information on standard construction type locomotives.

Chambers Bridge — A special type of transporting unit which was developed on the Mississippi levee construction and later used on the Florida Canal is known as the Chambers Bridge which consists essentially of a central tower, from which two structural steel arms, 175 ft. long, project in opposite directions and develop a 370-ft. runway for a 10-yd. dump car which is electrically controlled from a 150-hp. hoist in the central tower. The bridges are supported by wire ropes running down to the hoist and may be raised or lowered to attain the angle best suited to operating conditions. The entire machine is self-propelling, being mounted on crawler trucks, and can be maneuvered into working position with almost the speed of a large dragline. Its total weight is 278 tons. The car can be dumped anywhere along the arm and makes a complete cycle in about 50 sec. Its average output is about 9 yd. per cycle. It is loaded automatically from a stationary hopper in one end of the bridge, a time-saving feature because the hopper can be loaded while the car is on the move. A standard 5-yd. walking dragline has usually been employed in combination with the bridge as a loading unit. The

entire unit, with a crew of 12 men employed on the complete operation, handles an average of 8,000 to 10,000 yd. per day with a maximum of around 14,700 yd. A total of 260,000 yd. can be moved by this machine in one month.

Cableways as Transporting Units — Sometimes cableway equipment is the best means of doing a job as indicated in Fig. 1, where a cableway drag scraper is moving earth into an embankment for a railroad bridge approach. Occasionally the availability of a special cableway for other purposes permits the equipment to be worked into transporting service to considerable advantage. Such a special application involving the use of a 10-yd. rock skip was made at Madden Dam. The service consisted essentially of removing foundation excavation from deep areas where it was difficult to haul with trucks or tractors. Three 10-yd. skips were employed and were successively loaded with a dragline. A loaded skip was hooked to the dumping bridle on the cableway, raised approximately 150 ft. and

then transported a distance of about 1,000 ft. to the higher abutment level at either end. This operation ran for more than two weeks and the best performance was 100 skip loads in 8 hr. It was estimated that each load carried approximately 8 yd. of bank measure rock and earth. The average performance ran between 70 and 75 skip loads per 8 hr. The best time cycle for one operation was 3 min. 28 sec.

Tramways — Fig. 3 and Fig. 4 show a further example of transporting materials over cables. The aerial tramway is particularly suited to transport materials over mountainous or rough country where the quantity to be handled is sufficiently large to justify the first cost of the installation. On such projects as Madden, Pine Canyon, and Pardee Dams, tramways were used with considerable success in transporting gravel from pits located one or more miles from the dam sites. In the case of the Madden Dam project, more than 600,000 yd. of gravel was transported a distance of one mile at the rate of 225 tons of gravel per hour. The conveying speed was 500 ft. per minute and

a total of 50 buckets, each with a capacity of 32 cu. ft. were employed. A 100-hp. motor was required to keep the 2-mi. circuit of loaded and empty buckets in motion. A special loading terminal is required where the buckets automatically disengage from the traveling line and come to a stop under a loading chute, where the material is discharged from a storage bin into the buckets after which they again are engaged with the tramway line and carried out over the cable spans. The longest span was 1,826 ft. and the shortest 400 ft. At the discharge end, the buckets passed through a special discharge terminal where opening, dumping, and reclosing of the buckets occurred automatically without stopping them. The return travel of the buckets was accomplished by changing their direction in traveling halfway around a 16-ft.-diameter pulley. Tramways are not suited for direct loading from excavation equipment. One of the longest tramways is located in Peru and has a length of 30 mi.

Belt Conveyors — The use of belt conveyors for handling excavations has risen into greater prominence and the high quality of belting now obtainable has contributed as much to the increased use of belt conveyors as improvements in rubber tires have added to trucking and hauling service. We will here discuss only the handling of excavation; a later chapter will discuss conveyors for aggregate plants.

A conveyor layout is, as a rule, a special job and must be designed to fit local conditions. The accompanying table gives general performance data and characteristics of large conveyors. Lower speeds than those shown should be used in case of smaller belts or where it is desired to load the belt higher. The usual angles of slope for belt conveyors are 15 deg. for dry sand and for screened gravel, and 18 deg. for unscreened gravel. The shape of the particles has considerable influence on determining slopes as a con-

Characteristics of Belt Conveyors (Anti-Friction Type) For Material Weighing 100 Pounds per Cubic Foot — Lagged Drive Pulley

BELT WIDTH	MAXIMUM			BELT PLYS RECOM- MENDED 32 oz. Duck Battling with 2500 lb. per sq. in. Rubber Cover.	MAX BELT TENSION ^a Allowed @ 30 lb. per Ply inch Soft Ten- sion & Cover Friction Pull or TT lb./sq.in.	MAXIMUM LENGTH OF FLIGHT for HEAVIEST BELT (Cal. 6) (See Note Below)			RECOM- MENDED MOTOR SIZE FOR COLUMNS 6, 8, 9, 10	
	IN. ft. per min.	IN. SPEED RECOM- MENDED	SIZE PIECE Not over 60% of Total			C.Y. per hr.	SAND	BOULDERS	Lbs.	
11	22	22	44	(5)	(6)	44	1,230	820	410	11
14	300	3	75	3	4	1,680	1,080	790	510	15
16	300	4	100	3	4	1,920	1,000	680	370	15
18	350	5	150	3	5	2,700	1,180	860	520	25
20	350	6	180	4	5	3,000	1,180	840	500	30
24	400	8	300	4	6	4,320	1,180	810	440	40
30	450	11	525	4	7	6,300	1,230	820	410	75
36	500	14	850	4	8	8,620	1,220	800	370	100
42	550	17	1,250	5	9	11,300	1,210	770	330	150
48	600	20	1,800	5	9	13,000	1,100	640	200	200
54	600	24	2,300	6	11	17,800	1,190	730	270	250
60	600	28	2,800	6	13	23,400	1,300	840	370	325

^a Provides a Factor of Safety of 8. (This Table for Estimating Only)
NOTE: If less than max. belt plies are used, the lengths and power given should be reduced.



FUEL OIL ECONOMY

Tractor users are finding that fuel economy **ALONE** is not enough. Allis-Chalmers economy goes farther. In the Controlled Ignition Oil Tractor . . . Diesel fuel economy has been **COMBINED** for the first time with smooth, dependable operation, instant starting, greater simplicity, less dead weight and better balance.

Controlled Ignition eliminates the need for high compression pressures —thereby avoiding vibration, crank-shaft whip, terrific heat, excessive wear and strain on working parts—and expensive repairs. No special grades of fuel are necessary . . . special lubricating oil is not required . . . and there is no auxiliary starting motor. Investigate this improved principle of tractor operation!

ALLIS-CHALMERS OWNERS

REPEAT

ROBERTS PAVING COMPANY "REPEATS"

Hauling approximately 12 yards per trip, these Model "L-O" Oil Tractors move big yardage for Roberts Paving Company on their job near Harrisburg, Pa. Shown also is their Model "WK" and bulldozer. After experiencing the economy and dependability of A-C power—this contractor recently ordered two additional "L-O's"

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

INSTANT STARTING... LOW MAINTENANCE



Controlled Ignition **OIL**
TRACTORS

veyor should not be so steep as to permit rolling back of the material. Length of a horizontal conveyor flight is generally limited to around 1,100 ft. when carrying material weighing 100 lb. per cubic foot. This is due to the limits of allowable belt tension. For lighter materials, the length may be greatly increased. The most notable recent installation of belt conveyors for large construction projects are the Grand Coulee Dam, Fort Peck tunnels, and the Florida Canal projects. At Grand Coulee, more than 10,000,000 yd. was moved and this project represents one of the finest examples of conveyor installations, in which proper recognition was given to all of the various elements that go into the design of such a system. It is estimated that over \$1,000,000 was spent on the excavation plant on that project. The excavation system consisted of loading by shovels to tractors and wagons, which carried the material to grizzlies located flush with the ground surface and over heavy-duty feeders which were de-



Fig. 6 . . . MATERIAL FOR EARTH DAMS in Miami Conservancy District is hauled by train to hog-box from which mixture of gravel and water is pumped through dredge pipe to site of dam.

Output:									
Best in 7 hr.....									17,428 yd.
or.....									2,540 yd. per hour
Best in 21 hr.....									50,700 yd.
or.....									2,420 yd. per hour
Longest steady run.....									59 hr. 8 min.
Best month.....									1,120,000 yd.

SIZE (Max. Speed)	LOAD PULLED	LEVEL TRACK			3% ADVERSE GRADE			MAX. HAULING LOAD		
		TIME REQUIRED Minutes to Start, Stop, and Change in Distances Given Below in Feet		SPEED Maximum Attained	TIME REQUIRED Minutes to Start, Stop, and Change in Distances Given Below in Feet		SPEED Maximum Attained	LEVEL TRACK	3% GRADE	SPEED ATTAIN- ABLE WITH THESE LOADS
		500	1,500	2,500	500	1,500	2,500	TONS	TONS	M. P. H.
8 12 M.P.H.	10	.7	1.7	2.7	12	.8	1.8	2.7	12.0	
	30	.9	1.9	2.8	12	1.2	3.1	5.0	6.0	
	50	1.0	2.0	3.0	12	Max. load—44 tons				
10 13 M.P.H.	20	.8	1.6	2.5	13	.9	2.0	3.0	11.0	
	40	.9	1.8	2.6	13	1.4	3.2	5.1	6.0	
	60	1.1	2.0	2.8	13	Max. load—55 tons				
14 13.5 M.P.H.	20	.7	1.6	2.4	13.5	.9	1.8	2.7	13.5	
	50	.9	1.8	2.6	13.5	1.2	2.6	4.0	8.0	
	80	1.0	2.2	3.0	13.5	Max. load—77 tons				
20 15 M.P.H.	20	.7	1.5	2.2	15	.8	1.7	2.5	14.0	
	50	.8	1.6	2.4	15	1.1	2.3	3.5	10.0	
	80	.9	1.8	2.6	15	1.3	3.0	4.6	7.0	
30 17 M.P.H.	110	1.0	2.2	3.2	11.5	1.7	4.6	7.4	4.0	
	30	.7	1.4	2.1	17	.8	1.6	2.5	14.0	
	75	.8	1.5	2.2	17	1.0	2.1	3.2	10.0	
40 20 M.P.H.	120	.9	1.7	2.4	17	1.4	3.2	5.0	6.0	
	165	1.0	1.9	2.7	13.6	1.7	4.1	6.5	4.8	
	40	.7	1.4	2.0	20	.8	1.7	2.6	13.0	
60 25 M.P.H.	100	.9	1.6	2.3	18	1.4	2.9	4.4	7.0	
	160	1.0	1.8	2.5	16	1.6	4.1	6.5	5.0	
	220	1.1	2.0	2.9	14	2.1	5.3	8.6	3.5	
60 25 M.P.H.	60	.7	1.5	2.0	23	1.1	2.0	2.6	11.0	
	150	.9	1.7	2.3	20	1.3	3.3	5.2	6.0	
	240	1.1	2.0	2.7	16	1.8	4.7	7.5	4.0	
Below Heavy Line—Maximum Speed Not Attained. Below Dashed Line—Insufficient Power To Haul At Maximum Speed.										

pressed below the ground. A bulldozer was used to break down the largest sizes and force them through the grizzly into the feeder. These feeders delivered the material to 42-in. tributary conveyors which carried the earth to a central hub feeder which, in turn, fed the material in a smooth stream to a 60-in. main conveyor. The total time efficiency of the conveyor system was 95 per cent which shows the remarkable reliability of this class of equipment. The following table gives the

main characteristics of the Grand Coulee installation:

Total length of main conveyor	
Feeders and laterals	6,048 ft.
60-in. main conveyor	
Number of flights	19
Maximum slope	.14 deg.
Length of flights	156 to 415 ft.
Total length	4,648 ft.
Gross lift	626 ft.
Loss of lift in transfers	160 ft.
Speed of travel	620 ft. per min.
Power on each flight	200 hp.
Power on feeders and laterals	1,115 hp.
Power on discharge stacker boom	280 hp.
Total power installation	3,200 hp.

method for moving large quantities of earth and gravel is the system of hydraulic pumping which was used to a very large extent on the Miami Conservancy District and is fully described in its publications. This process was used as a means of developing a reclassification of the materials as is frequently necessary in the construction of earth dams. As shown in Fig. 6 the earth and gravel were hauled by train into large hog-boxes where they were mixed with large quantities of water and pumped through dredge pipe to the site of the dam. This was a very necessary operation because in the original state the material was a rather uniform mixture of gravel, sand, and some earth. This material was too porous to be used in a dam and the purpose of the hydraulic operation was so to combine the material with water that, at the discharge end, it would leave the gravel at the outer faces of the dam and grade uniformly toward the center of the dam where the finest particles would accumulate and settle to form an impervious core. On the Miami work, 15-in. pumps were used and more than 7,000,000 cu.yd. of material was pumped into the five dams. A run of 300 to 400 yd. per hour was frequently obtained, and a total of 91,500 yd. was put through a single pump in one month. Production rarely came up to the maximum dredge capacity of 600 yd. per hour due to the limited capacity of the hauling and sluicing system.

A more recent installation of the same type of operation occurred at Quabbin Dike, Mass., where 2,100,000 yd. was moved at the rate of about 8,000 to 10,000 yd. per day and 50,000 per week. This project is of special interest because the specifications provided for three different methods of moving the material from bank to dam; one by sluicing from the hillside directly into a pit where a dredge pump would transfer and pump it to the dam; the second, loading the material into trucks, the trucks dumping into hog-boxes, and the material sluicing out of these hog-boxes and flowing by gravity to the dam; third, the material loaded into railroad cars, dumped into hog-boxes, and delivered to the dam



Fig. 7 . . . EL CAPITAN DAM, containing 1,700,000 cu.yd., is constructed by semi-hydraulic process. Earth and gravel hauled by trucks are segregated and disposed by sluicing action.

by a dredge pump or by gravity flow. Fortunately, the ingenuity of the contractor was permitted to introduce a fourth and more efficient method which consisted of tractor and truck deliveries from the bank to a dredge pump set-up, with the material, however, going through a mechanical feeder and revolving grizzly into a concrete sluiceway to provide a constant feed to the pump. This was probably one of the most important features which led to the successful execution of this job. About 500 yd. of solids was pumped per hour, the solids running 13 to 15 per cent. A 20-in. line, 2,500 ft. long delivered the material to the dam. The pump was rated at 185-ft. maximum head with a 1,000-hp. motor driving it at 392 r.p.m.

Semi-Hydraulic Method of Dam Construction—Fig. 7 shows the El Capitan Dam when the earth was brought in by trucks and dumped along the outer edge, and segregation and redepositing of materials were obtained by sluicing the material down and letting the fine material run into the core. The trucks had about 1½-mi. haul, and the material was washed down by 2-in. and 3-in. nozzles, operating at pressures of 50 to 60 lb. per square inch and receiving water through 8-in. pipes. The pumps were mounted on rafts and delivered from 3 to 4 cu.ft. per sec. of water. Four such units placed a total of 8,000 to 12,000 yd. per day of two shifts, the water in general circulating and being used over and over. About 150 gal. of water

pend a great deal on the nature of the material. The highest losses occur in handling rough and sharp heavy gravel; the losses decrease where the sand content is greater, and the presence of fine clay has a substantial effect in reducing losses because of its lubricating effect. Mud and silt may run up to 20 per cent of solids, whereas sand and gravel usually run around 10 per cent in solids. The following table gives representative friction losses in pipe lines handling sand and gravel:

**FRICITION LOSS IN FEET
PER 100 FT. OF DREDGE PIPE
CARRYING WATER WITH SAND
AND GRAVEL**

Vel., ft./sec.	PIPE DIAMETER			
	10 in.	12 in.	16 in.	20 in.
10	6 to 9 ft.	5 to 7 ft.	4 to 6 ft.	3 to 6 ft.
12	10 to 13 "	7 to 10 "	6 to 8 "	4 to 8 "
14	13 to 16 "	10 to 13 "	7 to 10 "	6 to 10 "

About 20-ft. of head is lost on the suction side.

For large operations floating line pipe is generally made in 45- to 48-ft. lengths, which permits shipping the pipe in 50-ft. cars. On the Great Lakes and in certain other cases, lengths of 100 ft. have occasionally been employed because of their greater freedom from difficulty due to wave action. The length of shore pipe for dredges between 20 and 30 in. is between 15. and 16 ft. which allows easy handling. Dredge pipe is made of special composition steel with .30 to .40 carbon and with electric welded seams. The

means for the handling of shore pipe and are most satisfactory for casting up levees or leveling off high spots on the fills.

Representative performance with a medium-sized dredge is found at Pickwick Landing Dam where a 16-in. dredge with 800-hp. motor pumped a distance of 1,500 to 1,800 ft. and the booster pump extended this distance to about 3,700 ft. The material ran about 8 to 10 per cent solids, and contained a large amount of gravel, with smaller size material ranging down to clay. The shrinkage in moving the material from bank into the hydraulic

systems. About 5.38 kw.hr. is used per cubic yard of material moved, which is sand and silt, running about 13.2 per cent solids. The velocities have been around 20 ft. per second, and the floating line loss runs from 4 to 7 ft. per hundred foot of length, whereas the land line loss runs from 3 to 5 ft. per hundred feet of length. This low line loss is obtained through exceptionally accurate alignment.

Barges—For certain special conditions of service on rivers, barges may prove most effective, as is the case at Wheeler Dam where gravel was delivered from a ladder dredge a distance

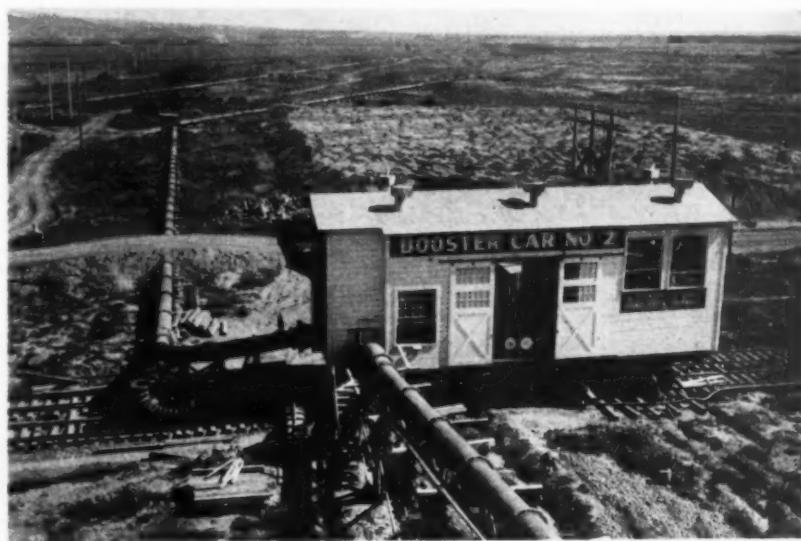


Fig. 8 . . . ACCURATE ALIGNMENT OF dredge pipe holds line losses to minimum at Fort Peck dam. Booster pumps on cars increase distance through which material is pumped.



Fig. 9 . . . DISCHARGE END of dredge line at Pickwick Landing dam builds up disposal at left while dragline raises retaining dike at right.

were used per cubic yard of fill.

Dredge Pipe—Since dredge pipe lines are essentially a transporting medium as distinct from the dredge which was discussed under the subject of Excavating Equipment, a special discussion is here presented, although the pipe line and the dredge comprise a single operating unit.

Certain principles should be observed in laying out a pipe line: first, the floating line should be as short and as straight as possible; second, the land layout should as far as possible be on accurate alignment and evenly graded. Friction losses in the lines de-

thickness of floating pipe runs from 5/16 in. to 7/8 in., and shore pipe is usually 1/8 in. to 5/16 in. for smaller dredges.

For long distance lines, it is necessary to install boosters and these are usually pump units of the same type and characteristics as those located in the dredge itself. It is particularly important that all boosters and pumps run at the same speed and since some pressure, around 5 or 6 in., should be maintained at the entrance side of the booster its proper location in the line is equally important.

Light draglines offer an efficient

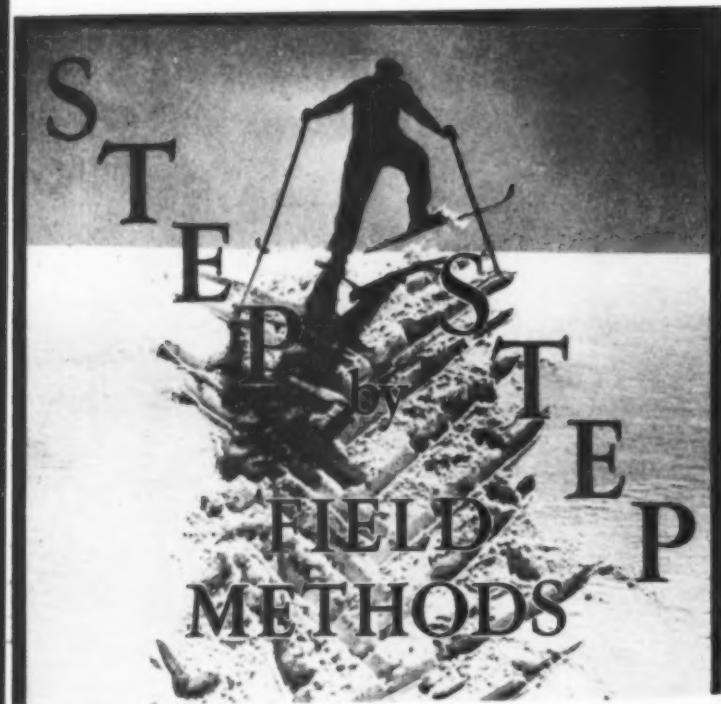
fill dam amounted to 12 per cent, and a total of 150,000 to 175,000 cu.yd. was placed per month. About 2.5 to 3.5 kw.hr. of energy was used per cubic yard. The most notable installation of dredging now exists at Fort Peck dam where the distance of transportation is 17,000 ft. and the vertical rise is 240 ft. in elevation. Five 28-in. pumps are used in series and 6,250 hp. of power are used on each pipe line. About 1,200 to 1,900 cu.yd. per hour is moved or a total of 3,300,000 yards per month by four such dredge systems. The biggest day was 189,000 yards on July 3, 1936, by the four

of 25 mi. upstream to the dam. Special deck barges were used for this purpose which permitted the water in the materials to drain off in transit. For maximum economy, it is desirable to have large barges with capacities of 400 to 600 tons per barge to reduce the cleanup cost in unloading. In certain special cases, self-unloading barges of the mechanical or the tip-over types are advantageous as on deep sea dumping.

Summary—Transporting equipment and conditions under which it operates represent such a large number of varied conditions that, as one manufacturer put it, "Knowledge of new equipment and the ability thoroughly to analyze jobs is absolutely necessary in order to keep abreast of the times. The old-time construction man is fast being replaced by the construction engineer, who, by virtue of his training, is capable of making a proper job analysis." This might be reworded by saying that the old-time construction man must learn to utilize the ability and assistance of equipment experts in order to keep from being displaced.

♦

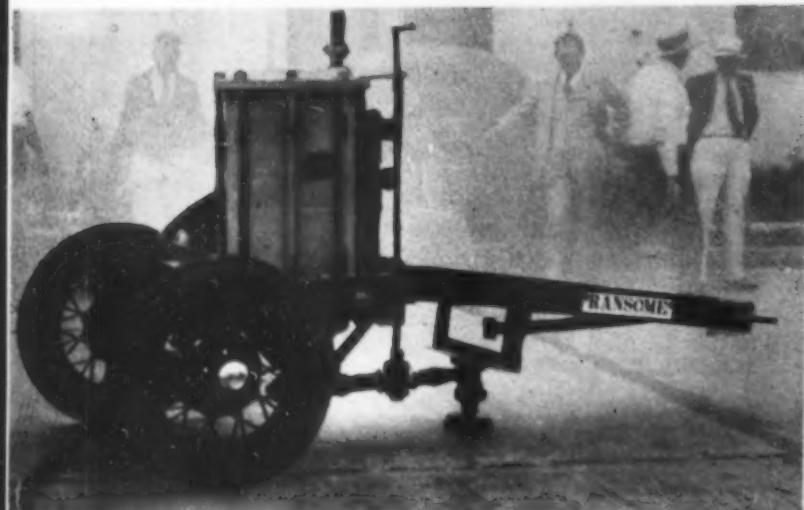
NEXT MONTH—Chapter 17 of the series on "Heavy Construction" by A. J. Ackerman and Charles H. Locher, to appear in the May issue, will discuss rock drilling and air compressors.



Mobile Grout Machine Fills Voids Under Pavement Patches

1

FOUR MONTHS after pavement cuts have been patched, mobile drilling outfit (right) opens 2-in. hole in center of each patch.



3 PNEUMATIC MIXER AND PLACER is wheeled into position with discharge pipe centered in hole. Machine mixes 1:6 grout and places it in cavity at pressure of not more than 15 lb. per square inch. Weight of machine on sponge rubber gasket 2 in. thick prevents air leaks at pavement surface.

4 WITH FILLING COMPLETED, grout machine is hitched to truck (right) to travel to next job.

TO IMPROVE the convenience of filling voids under pavement patches with a Ransome grout mixer and placer, according to the method developed by Dennis J. Manning, assistant superintendent of distribution for the Elizabethtown Consolidated Gas Co., of Elizabeth, N. J., the manufacturer of the machine has mounted it on a pneumatic-tired two-wheeled trailer which facilitates movement and provides sufficient weight on the sealing gasket to prevent blowouts when the discharge pipe is feeding grout under pressure through a drilled hole in the pavement. Mounted on three legs, the machine has been used for years in grouting tunnels and dam foundations. Thus equipped it served

successfully in its original adaptation to filling voids under pavement, although the tripod mounting made the unit awkward to move.

Mounting the machine on a two-wheeled trailer has given it a new mobility which makes it easy to shift by hand on the pavement and equally easy to transport from job to job by hitching to a truck. The unit mixes and places 2 cu.ft. of grout at one charging or places 3 cu.ft. of premixed grout. Air is supplied by a compressor through a hose connection.

When used for mixing, water is placed in the machine and a valve is opened to admit compressed air at the bottom of the cylindrical chamber. The escaping air agitates the water and produces prompt mixing when cement and sand are added. For grouting, the charging door at the top of the chamber is closed, and air is admitted at the top by opening the proper valve, forcing the grout through the discharge pipe. Discharge is controlled by a valve in this pipe. When the chamber is emptied, the operator opens a relief valve on the grouter, and the charging door falls open as the pressure is relieved. An experienced operator knows when to close the discharge valve to prevent air from escaping under the pavement.



2

ELECTRIC LIGHT (right) lowered into 2-in. hole reveals depth of subgrade settlement. If settlement exceeds 1/2 in., grout machine is brought into operation to fill void.



Present and Accounted For~



A PAGE OF Personalities



**MAINE
LEGISLATURE**
gets representative from construction business in person of **WILLIAM H. HINMAN**, president and treasurer of W. H. Hinman, Inc., general contractors, Skowhegan, Me. Mr. Hinman, who has built important highway and bridge projects in Maine and Massachusetts, will represent Skowhegan in state legislature for two-year term.



HERSHEY SPORTS ARENA

at Hershey, Pa., described elsewhere in this issue, is constructed with advisory assistance of **L. H. DOANE** (left), engineer consultant, under direction of **D. PAUL WITMER**, manager, Hershey Lumber Products.



TENNESSEE ROAD BUILDERS' ASSOCIATION

has been led for almost two years by President **WADE E. MOORE**, who is vice-president of Forcum-James Co., contractors, Memphis, Tenn., as well as vice-president of Pioneer Contracting Co. and member of W. R. Aldrich & Co., L. O. Brayton & Co. and Forcum-James Construction Co.



CONVENTION ADDICT

Whenever and wherever contractors meet in annual convention it's safe bet that among those present will be **RICHARD HOPKINS** (left), of Albany, N.Y., highway contractor, philosopher and former engineering professor at Cornell. Here's Dick a long way from home, contemplating Old Man River from Huey P. Long bridge at New Orleans, La., scene of annual convention last January of American Road Builders' Association.

ASSOCIATED GENERAL CONTRACTORS OF MISSOURI

are headed during 1937 by **MURRAY N. WINDLE** (right), elected president for this year. Mr. Windle is vice-president of C. H. Atkinson Paving Co., Chillicothe, Mo., engaged principally in building concrete pavement. Since 1924 company has constructed for Missouri State Highway Department about \$10,000,000 worth of concrete paving contracts.

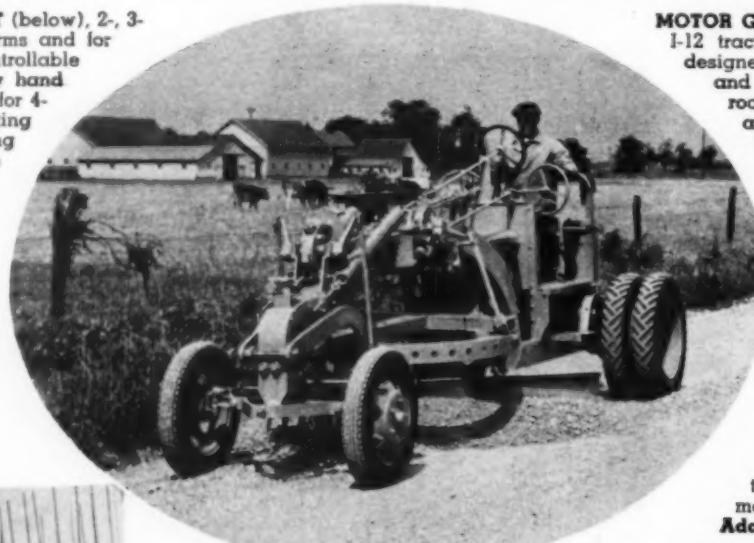


Construction Equipment News

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Review of Construction Machinery and Materials for April, 1937

ALL-WELDED CYLINDRICAL CONCRETE BUCKET (below), 2-, 3- and 4- yd. capacities, for operating in close forms and for handling low-slump concrete. Bottom-dump controllable type. No projecting levers. Operated entirely by hand wheel set into outer shell of bucket. Two wheels for 4-yd. buckets. Added safety feature: No projecting parts to catch on forms, reinforcing steel or clothing of men. Control gate so mounted to make bucket self-closing at any time during pour. Operating mechanism protected by shields. — Dravo Corp., Pittsburgh, Pa.

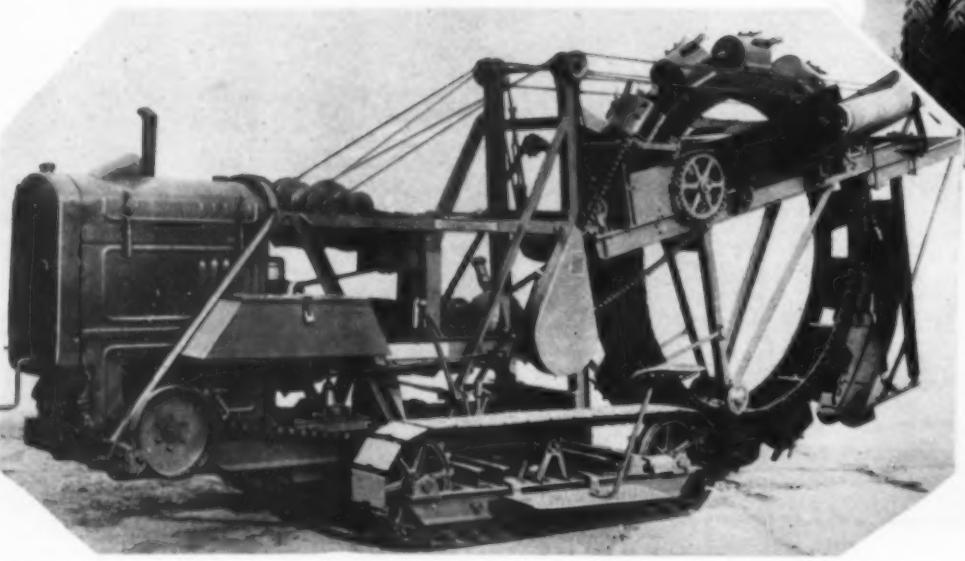
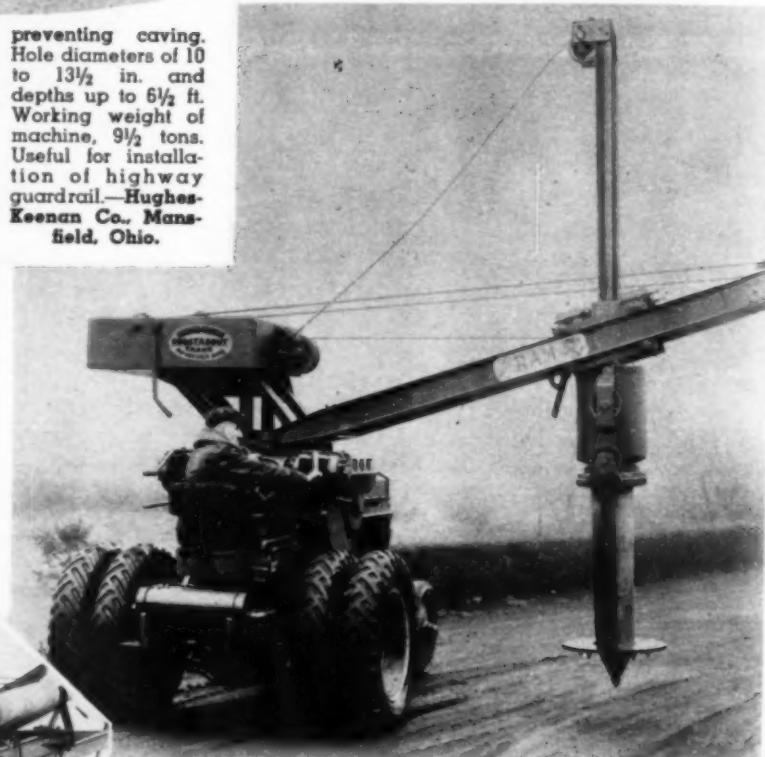


MOTOR GRADER (left), powered by International I-12 tractor with 22½-hp. engine is especially designed for maintenance of unimproved streets and alleys, for grading and maintaining roads and runways in parks, golf courses and airports, and for township and county light road maintenance. Two large roller chains from tractor axle drive rear axle effecting speed reduction and increasing pulling power 65 per cent. Three working speeds, 2, 3.5 and 6 m.p.h. are controlled by foot and hand throttles. Machine attains speed of 7.5 m.p.h. when empty. Other features: (1) narrow, all-welded, box-type frame; (2) machine-finished ball and socket connections and machined full circle; (3) hand wheels for raising and lowering of blade. Standard equipment includes 9-ft. blade. Approximate weight, 8,300 lb. Optional equipment: 10- and 12-ft. blades, scarifier, canopy top, inclosure, starting and lighting mechanism and other accessories. — J. D. Adams Co., Indianapolis, Ind.



POST HOLE DRIVER (right), designed by Lee S. Gaty, for installation on any make of tractor of 30 hp. or larger size, is equipped with 500-lb. plunger, pointed at lower end, and driven into ground by fall of 1,500 lb. weight, raised and dropped like piledriver. Counterweighted boom carries sliding leads so that plunger can be spotted over site of hole. Plunger has air inlet at point to eliminate suction during withdrawal. Driving compresses earth around hole,

preventing caving. Hole diameters of 10 to 13½ in. and depths up to 6½ ft. Working weight of machine, 9½ tons. Useful for installation of highway guardrail. — Hughes-Keenan Co., Mansfield, Ohio.



FULL-CRAWLER DITCHING MACHINE (left) for pipe line construction cuts trenches from 10½ to 23 in. wide and 5½ ft. deep. Digging speeds range from 1½ in. to 33 ft. per minute. Top road speed, 3 m.p.h. Power furnished by 325-cu.in. gasoline engine, developing 38.5 hp. at 1,000 r.p.m. Distinctive features: (1) unit type construction; (2) steel-enclosed, dirt-sealed drives; (3) differential brake steering; (4) quick shift, arc-type conveyor; (5) close-up view of digging action from operator's platform; (6) use of more than 90 anti-friction bearings; (7) unusual use of alloy, heat-treated steels. Ground bearing pressure 5.5 lb. per square inch; with auxiliary 16 in. cleats 4.3 lb. per square inch. Total weight, less than 6 tons. Can be loaded or unloaded (10 to 15 min. required) on specially built trailer for speedy transportation. — Cleveland Trencher Co., Cleveland, Ohio.



WAGON DRILL developed to meet wide variety of drilling conditions has adjustable mast and wheels and may feed either by gravity with an air hoist or by means of a pneumatic cylinder. Mast may be tilted to permit drilling in any position from 9 deg. above horizontal to 5 deg. past vertical. Drill is raised or lowered by means of feed cylinder which has regulating valve to obtain proper drilling pressure. Centralizer permits collaring hole quickly and properly after which drill is freed and successive changes made without interference. Height (less steel ring) 18 ft.; overall length, 10 ft. 6 in.; steel change, 10 ft.; wheel adjustment permitting 90-deg. swing; weight, 1,830 lb.—Gardner-Denver Co., Quincy, Ill.

Further Information
Requests for further information should be sent to:
The Editor,
CONSTRUCTION
Methods and Equipment
330 West 42nd Street
New York, N. Y.



PORTABLE ROTARY PUMP (above) for handling asphalt emulsions, oils and similar materials used in treating driveways, widening projects, shoulder redressing work and sur-



GAS POWER UNIT VIBRATOR (below and inset) for placing and compacting low water-cement ratio concrete is supplied in models designed to handle

all conditions of concrete construction from highway work to heavy mass concrete and to make dense, plastic concrete from mixes heretofore considered harsh

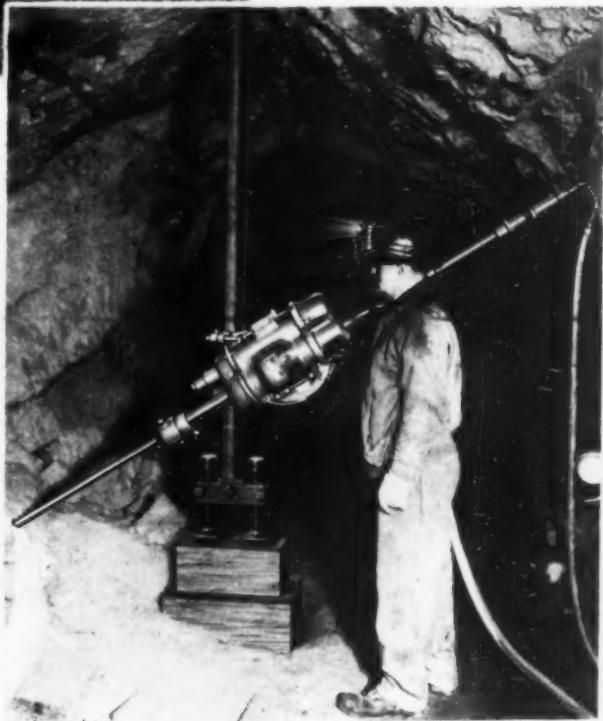
and unworkable. Vibrating speeds ranging from 1,800 to 6,000 r.p.m., easily and quickly adjustable. Can be equipped with any length shaft up to 30 ft. by joining standard shaft lengths with special couplings. Vibrating ends need no lubrication and are tamper proof. Supplied in three models: Master 20, two-wheel pneumatic-tired buggy type; Master 21, single pneumatic wheel, wheelbarrow type; and Master 22, single pneumatic wheel pedestal type with swivel base. Powered by Briggs & Stratton engine. Vibrator ends furnished in 1½-, 2½- and 3½-in. diameters.—Master Vibrator Co., Dayton, Ohio.



STUMP PULLER (below) for clearing land of stumps and trees up to 5 ft. in diameter is equipped with flexible shaft drive which may be connected with rear power takeoff of any tractor in a few hours, making special power unit unnecessary. Line speed: Low, 8 ft. per minute; high, 75 ft. per minute. Direct line pull, 100,000 lb. Drum capacity: 1-in. cable, 200 ft.; ½-in. cable, 500 ft. Weight, 2,100 lb. One operator controls tractor and stump puller. For anchoring, hooks are provided on puller to which anchor cable is attached. All-steel construction. Capacity, 300 stumps per day. Accessories: takeups (cable and hook); power pulleys; cluster and root hooks.—Dorsey Brothers, Elba, Ala.



EXPLORATORY ONE-MAN DIAMOND DRILL (below) adaptable for all types of drilling within its range, either from surface or in locating or following a vein underground ahead of winzes, stopes, drifts and cross-cuts. Advantages claimed: lightness of weight, compactness, full power and full control over both drilling speed and bit pressures. Although design is totally inclosed, weight is kept low through use of heat-treated well-ribbed, aluminum alloy castings, making it possible to transport machine by airplane, muleback, small boat or canoe. Three rates of forward speed or neutral available by shift of external gear selector. Oversize ball bearings used throughout.—Ingersoll-Rand Co., Phillipsburg, N. J.



face patching jobs. Pumps directly from drum container through discharge hose and spray nozzle distributing even layer of material over surface being treated. Driven by 2-hp. air-cooled engine through completely inclosed V-belt drive. Mounted on two-wheel roller bearing truck. 1-in. suction; 1-in. discharge. Capacity, 10 g.p.m. Total head, 175 ft., or maximum pressure, 75 lb. Net weight, 255 lb. Similar model, capacity 20 g.p.m.—C. H. & E. Manufacturing Co., Inc., 3849 N. Palmer St., Milwaukee, Wis.



ELECTRICALLY WELDED STEEL PIPE constructed by special automatic method creating unobstructed, smooth surfaced waterway. Made in 40-ft. lengths reducing number of field joints and probability of leakage after installation. Also lessens handling and laying costs. Advantages of steel pipe such as ability to handle high pressures with low pipe weight and ease of repair together with particular characteristics of Alco manufacture produce product fitted for severe service conditions. Manufactured in diameters from 20 in. up and with either spun bituminous linings or hot dip asphalt coatings. Use of flexible couplings permits easy installation at lower cost. — Alco Products, Inc., 30 Church St., New York.

SMALLER SIZE PUMPCRETE MACHINE (right) (Rex Model 160) with 6-in. discharge pipe line and rated capacity of 15 to 20 cu.yd. per hour is designed for projects involving a maximum of 5,000 cu.yd. of concrete to be placed. Hourly capacity is sufficient to handle $\frac{1}{2}$ -yd. mixer. Pneumatic tire mounting for towing from job to job. Powered by 4-cylinder, 25-hp. gasoline engine. Maximum aggregate size, 2 in. Pipe line length up to 800 ft.; vertical lift of 100 ft. Bore of cylinder, 6.3 in.; piston stroke, 12 in.; speed 50 r.p.m. Hopper capacity, $\frac{3}{4}$ cu.yd. Total weight, with engine and hopper, 5,600 lb. Overall dimensions: length, 11 ft. $7\frac{1}{2}$ in.; height, 5 ft. $6\frac{1}{4}$ in.; width, 4 ft. $8\frac{1}{2}$ in. Designed on same principles as larger Rex models. — Chain Belt Co., Milwaukee, Wis.



Construction Equipment News

(Continued)



TRAVEL PLANT FOR BITUMINOUS SURFACING (left) with all types of aggregates enables contractor to take advantage of high quality, low cost mixed-in-place method by closer control, automatic operation, thorough mixing and reduction of weather hazards. Bucket loader picks up windrowed aggregate and feeds it to mixer hopper where it is weighed, sprayed with metered bitumen and discharged into twin pug-mill which mixes material and discharges it in windrow form at rear of machine. Quality is assured by accurate proportioning made possible by patented continuous feed of aggregate and bitumen in predetermined ratio. Other advantages: (1) thorough mixing; (2) short mixing cycle (2 min.); (3) savings by using salvaged or available material; (4) saving of bitumen; (5) simpler, cheaper aggregate handling and drying; (6) speed of construction. — Barber-Greene Co., Aurora, Ill.

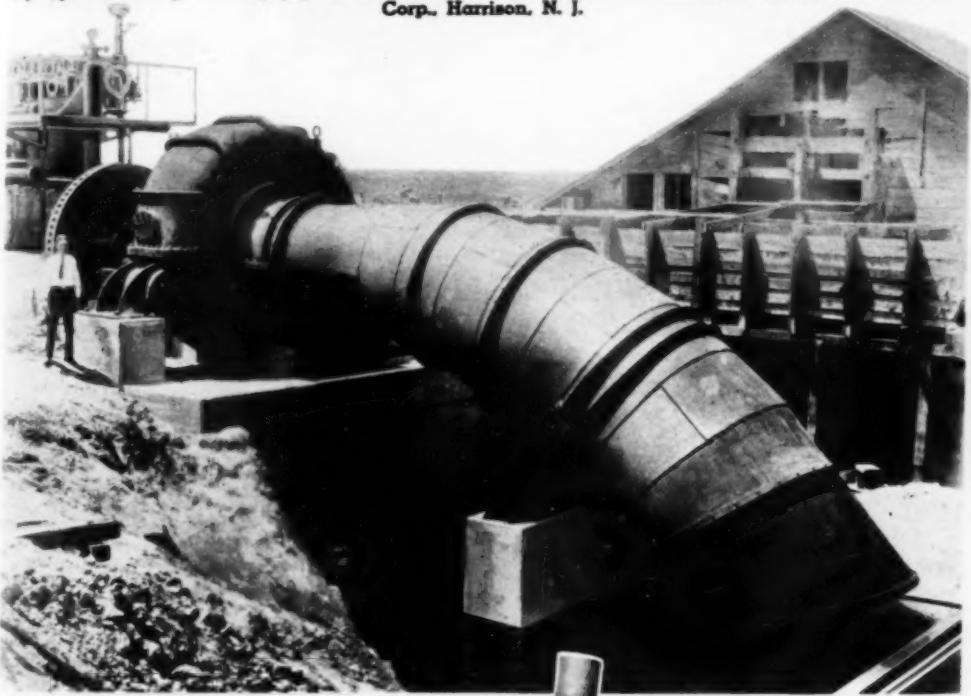


PLASTER AND MORTAR MIXER (below) designed to furnish at low cost a dependable and good quality mix of patent hair fiber, putty, plaster, magnesite or mortar. Will not ball or pull hair. Eliminates hand mixing and breaking down on hawk. Original feature, new bag splitting blade which eliminates hand cutting of paper bags. Trailer mounting so balanced that one man may move mixer to any desired location. Engine clutch control at front within easy reach. Paddles, adjustable to fit closely to shell, scrape and clean drum when revolving. Perfectly balanced drum tilts easily, weight being carried on independent trunnion bearings and not on paddle shaft. Made in 6- and 10-cu.ft. sizes. — Ransome Concrete Machinery Co., Dunellen, N.J.



WOOD VENEER INTERIOR FINISH (left) with Celotex backing, known as C-X Texbord, is now available in mahogany, avodire and walnut for use in moderate priced homes. It is $\frac{1}{4}$ in. thick and comes in units 6, 9 and 12 in. wide and 8 and 10 ft. long. Easily applied to plastered surface without nails being visible and with no special moulding. May be used in either old or new construction as it is flexible and can be made to conform to average variations in wall surfaces. Its application in modernization jobs does not make necessary removal of baseboards, mouldings and door and window casings. — The Celotex Corp., 919 N. Michigan Ave., Chicago, Ill.

CENTRIFUGAL PUMP (below) for irrigation, drainage, sewage disposal, condenser circulating and low-head water supply is available in sizes ranging from 12 to 84 in. for capacities from 1,000 to 225,000 g.p.m. and heads from 5 to 50 ft. "Mixflo" design which permits higher rotative speeds for given capacity and head, also produces steep head-capacity characteristic allowing small capacity variation for wide variation in head. Pump can be started dry and brought up to normal speed before priming, thus permitting use of low starting torque drivers. Where necessary pump may be equipped with impellers having relatively flat power curves at slightly reduced rotative speeds. Installations possible: (1) direct-connected to horizontal synchronous or induction motors; (2) gasoline, diesel or gas engines; (3) vertical floor mounted, either close coupled or connected through shafting to vertical electric motors, gears or steam turbines; (4) vertical dry-pit mounted and connected to vertical motors, gears or steam turbines by open shafting, or drop pipe mounted for wet pit service. — Worthington Pump & Machinery Corp., Harrison, N. J.

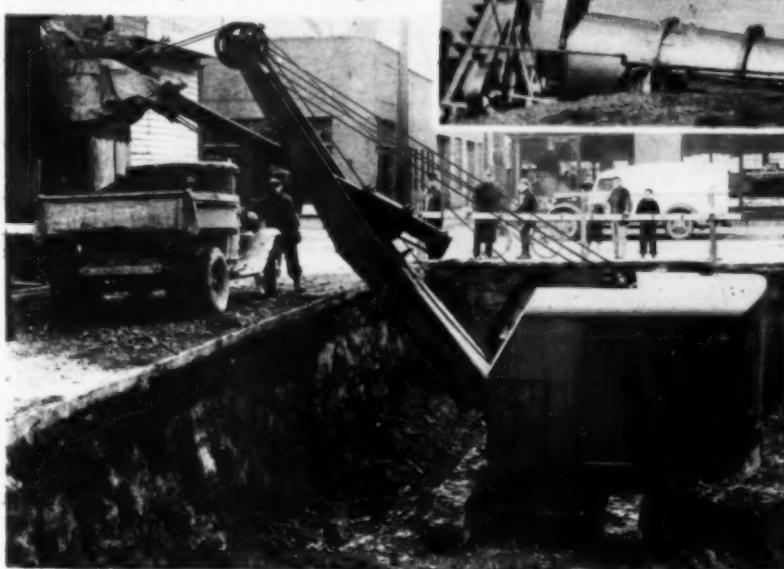


PORTABLE ASPHALT PAVING PLANT (right) in sizes from 500 to 5,000 lb. per batch, is designed in self-contained units for easy dismantling and erection at new locations. Transported on own wheels or trucks and trailers. Automatic, electrically controlled weighing and timing. Four feed bins for sand and rock. Dryer is of two-tier revolving type heated by fuel oil. Hot elevator, of chain bucket type, is inclosed and dust tight. Vibrating screen over all-steel hot storage bin. Dust filler bin has screw for charging weigh box. Asphalt weigh bucket steam jacketed. Mixer is of twin-shaft pug-mill type. — Standard Steel Works, 5001 Boyle Ave., Los Angeles.



ELECTRIC DISK SANDER built for production and repair work. Equipped with high-speed universal motor inclosed in

strong aluminum alloy housing. Ball bearings used throughout. Furnished complete with 7-in. flexible pad, twelve sanding disks (six for metal and six for wood), wrenches and heavy rubber-covered three-conductor cable. Used for cleaning metal vats, polishing metal pipes, removing labels and stencils, sanding wood and metal, removing paint and rust, rubbing and polishing lacquered surfaces, grinding heavy welds, smoothing concrete, limestone and similar materials, and also castings and auto fenders before and after filler is applied. — Stanley Electrical Tool Division, Stanley Works, New Britain, Conn.



CONVERTIBLE 1/4-YD. SHOVEL designed primarily for speed has cast steel bases and side frames cast integrally with rotating base. Travel gears fully inclosed. "Feather-touch" control assuring easy operation and cushion clutch which limits hoist rope pull are standard equipment. Cone-type swinging clutches, smooth acting, non-grabbing and cool running. All high speed shafts mounted on ball or roller bearings. Power take-off is through helical gears running in oil in oil-tight housing. Powered by Wisconsin six-cylinder gasoline engine. Electric or diesel power available. Shovel equipment, standard Northwest welded boom and dipper stick and manganese 1/4-yd. dipper. All operating parts above deck accessible within standard operating cab. — Northwest Engineering Co., 28 East Jackson Blvd., Chicago, Ill.



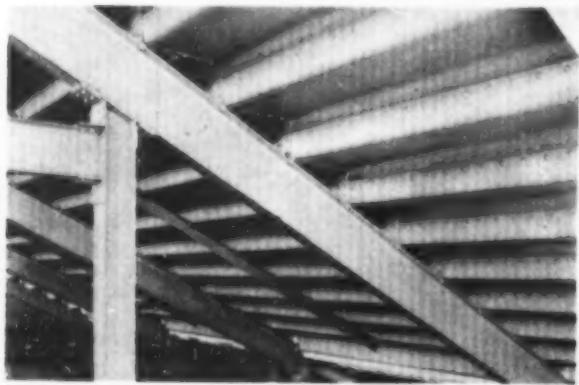
SINGLE-FRAME BLADE GRADERS (above) in 12- and 10-ft. sizes for combination work in which quick movement of blade from ditching position to high bank cutting position is necessary. Power-controlled models require less than 1 min. to move blade from one position to other and on hand-controlled machines shift may be made without offsetting blade on blade arms or making any changes in lifting or lateral shift links. Made of two 9- or 8-in. ship channels, according to model, about 4 in. apart in center. Steel plate is welded over top and bottom of channels forming 11-in.-wide box-type frame member of great strength and rigidity. Back of blade arm mounting, frame channels separate and form two members each having plates welded between channel flanges. Telescopic-type blade lift links may be extended for extreme blade positions in unusual jobs. — Caterpillar Tractor Co., Peoria, Ill.

Construction Equipment News

(Continued)



HEAVY-DUTY TIRES for use on motorized equipment used to move large quantities of soil and rock in mining and construction fields. Known as "Earth Movers," they carry maximum of 15,740 lb. or nearly 8 tons a casing; are mounted on 13-in. rims; weight 449 lb.; available in 12-, 16- and 20-plys. Tubes weigh 53 lb.; flaps, 12 lb. Four tires mounted on one axle will carry 60,000 lb. Available with two types of tread, one for trailer on free moving wheels and one with super-traction tread for use on mud and soft ground. — B. F. Goodrich Co., Akron, Ohio.



ALL-STEEL GRANDSTANDS for every type of athletic field, race track, arena, auditorium and theater are built in standard sections 18 ft. long by 10 rows deep, each section seating 120 persons. Seating capacity may be increased at any time—double decked, if necessary. Wood seat planks supported on brackets are securely bolted to deck. Substantial handrails surround stand. Aisles and walkways are provided for at proper intervals. Entrances and exits by stairs or ramps or through wells on stand. Steel deck built to shed water; hence, space under stands may be utilized for dressing rooms and storage. Stands are permanent—they do not weather, rot or decay. Assembled with bolts, they can be dismantled quickly and easily. Occasional coat of paint is only maintenance necessary. — Pittsburgh-Des Moines Steel Co., 3421 Neville Island, Pittsburgh, Pa.

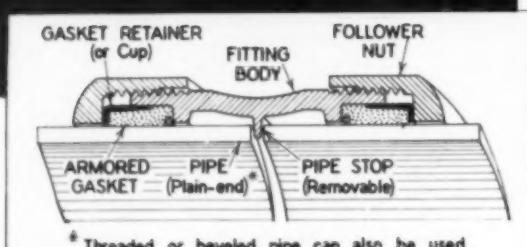


CRAWLER-MOUNTED WAGON SCRAPER is said to be available for use more days of the year as crawlers provide ample traction and load-carrying ability during greater part of wet season and allow for operation in wet soils and under conditions unfavorable to wheeled

scrapers. Use of crawlers also provides better traction in frozen, snow-covered ground. Crawler-equipped wagon scrapers may be had in all sizes—5-, 7- and 10 yd.—Continental Roll & Steel Foundry Co., Tractor Equipment Division, East Chicago, Ind.



BALL-BEARING ELECTRIC DRILL (left), slow-speed, high torque, $\frac{1}{4}$ - and $\frac{1}{2}$ -in. sizes, for drilling in steels of high nickel content, such as Monel and Allegheny metals and stainless steel. Slow speed lengthens life of twist drills, eliminating need for sharpening. High torque feature makes impossible stalling of drill at maximum drilling capacity. Design of $\frac{1}{2}$ -in. model unusual for drill of this capacity. One-hand grip feature makes it ideal for close quarter work and for use with hole saws. Ball-bearings on armature and spindle. Available in speeds of 350, 450, 600 and 750 r.p.m. Aluminum alloy bodies. $\frac{1}{4}$ -in. drill, 14 in. long; weight, 6 $\frac{1}{2}$ lb. $\frac{1}{2}$ -in. drill, 14 $\frac{1}{2}$ in. long; weight, 8 lb. — Skilsaw, Inc., 3814 Ravenswood Ave., Chicago, Ill.



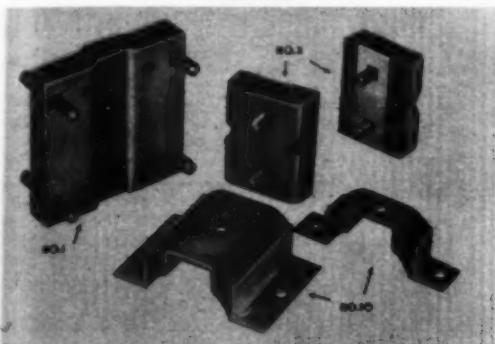
* Threaded or beveled pipe can also be used.

STANDARD PIPE FITTINGS (left, in inset above and in sketch) eliminate necessity of cutting pipe to exact lengths, threading, grooving, flaring or screwing up joints in cramped quarters and enable mechanic with ordinary wrench to complete joint in few moments. After inserting plain-end pipe into fitting (which comes completely assembled) it is only necessary to tighten two threaded octagonal

follower nuts with few quick turns of wrench. Resilient "armored" gaskets at each end of fitting are compressed tightly around pipe, forming positive seal. Resulting joint is not only tight but also absorbs normal vibration, expansion and contraction, and permits deflections of pipe in joint. Complete line includes: standard and extra long couplings, ell (both 45 and 90 deg.) and tees, all supplied in standard steel pipe sizes from $\frac{1}{2}$ in. to 2 in. i.d. inclusive, black or galvanized. Recommended for simplifying joint making and for repair work on both inside and outside piping, for oil, gas, water, air or other industrial lines. — S. R. Dresser Mfg. Co., 385 Fisher Ave., Bradford, Pa.



SCREW TAKEUP for conveyors and elevators is protected from dust by inverted V-shaped shield which extends from end to end of takeup frame. Sliding base casting, which carries bronze adjustment nut, is cored out in such a way that it slides freely over shield, thus relieving shield of all functions except protecting screw. As adjusting screw does not travel out of frame it is protected at all times, not only from operating strains and shocks, but also against all load, bearing being rigidly clamped to rugged steel frame after adjustment. — **Jeffrey Manufacturing Co., Columbus, Ohio.**



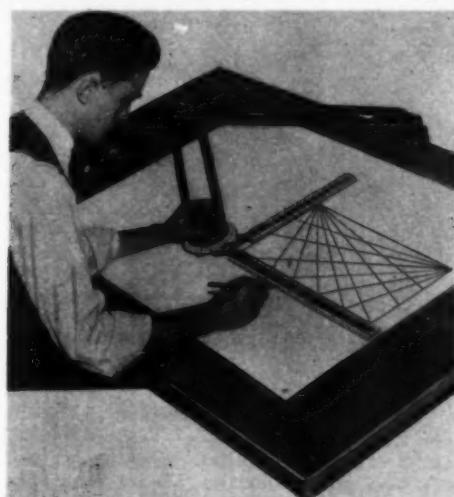
RUBBER SUSPENSIONS called "Vibro-Insulators" for application on mechanical equipment to absorb shock and vibration and to reduce noise. Designed to carry loads in shear, they have sensitivity to movement eight times greater than if rubber carried load in compression. Three standard types, Types 1 and 2 made in single standard size and require angles or other steel sections as mounting base. Type 10 is made in various lengths proportionate to load carried. The 1-, 3- and 6-in. lengths are shop-drilled with 5/16-in. bolt holes and ready for mounting. Type-10 sizes longer than 6 in. are shipped undrilled, permitting holes to be located as required. — **B. F. Goodrich Co., Akron, Ohio.**



BRONZE VALVES, in globe and angle patterns and in 1 1/4-, 1 1/2- and 2-in. sizes, are equipped with hard, stainless steel seats and disks. Trim is heat-treated to hardness of 500 Brinell and then machined on Diamond boring machine. Hardness enables valves to smash paper clips, nails, pipe turnings, boiler scale and sand without leaving trace of mark either on valve seats or disks. Illustration shows steel nail which makers state was crushed between seat and disk of 2-in. valve. Unusual hardness gives valves added resistance to wire drawing and steam cutting and thus lowers maintenance costs. — **Hancock Valve Division, Bridgeport, Conn.**

DRAFTING MACHINE, known as "K&E Paragon Drafting Machine," controlled entirely by left hand, is designed to replace all tools handled most frequently by draftsman. Consists of aluminum alloy jointed arm with protractor head fitted with two scales at 90 deg. Parallel motion maintained by tempered steel bands, under constant tension, concealed in arm sections. All moving parts turn on fine quality precision ball bearings for ease and uniformity of operation. Protractor head allows scales

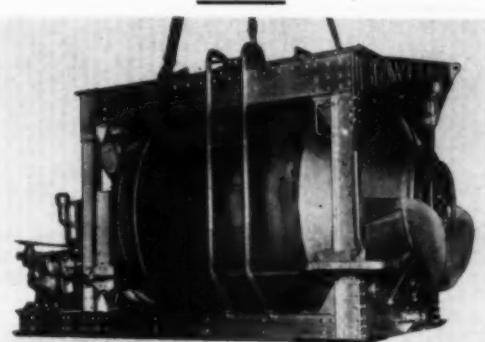
to be set and locked at any angle, to move freely in angular displacement or to stop automatically every 15 deg. Variations of scale angle are made by locking and stop mechanism operated by single lever in left hand of operator. Interchangeable



scales may be quickly attached or removed. Two models: standard type with spring counterbalance for use on drawing boards at any angle up to 15 deg.; vertical type with weighted counterbalance for use in any position of board from horizontal to vertical. — **Keuffel & Esser Co., Hoboken, N. J.**



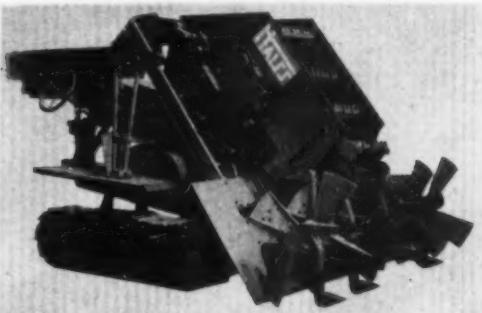
INDUCTION MOTORS, riveted-frame, squirrel-cage polyphase type, in frame sizes of from 1 to 15 hp. at 1,800 r.p.m. have new insulation system for stator coil windings of random-wound type with joints at connections fused instead of soldered, producing assembly with high resistance to moisture and other deleterious influences, such as mild acids, alkalies, oil and abrasion. Convenience features include: (1) two-part conduit boxes for ready access to leads; (2) handy knock-off ledges on end shields, permitting easy disassembly; (3) adequate wrench room for removing end-shield cap screws; (4) ball bearings provided with pressure grease fitting and relief plug; (5) sleeve bearings equipped with oil-filler gage that can be placed on either side of housing; (6) general simplicity and accessibility of parts. — **General Electric Co., Schenectady, N. Y.**



6-YD. AGITATORS are used for keeping concrete in constant motion by U.S. Reclamation Service when transporting material by cableways and cranes to its project in Boulder City, Nev. Three of these units, supplied by Blaw-Knox Co., include separate gasoline engine drive and transmission for revolving drums and agitating concrete during transit. Agita-

tors are loaded with 6 cu.yd. of mixed concrete at central mixing plant and then are transported on flat bed trucks to point where they can be lifted either by cableways or cranes which hook on to agitator boxes by means of three-part cable slings to transport agitators and loads to points where concrete is to be used. Agitators are of standard design, with exception of heavy structural frame to permit this unusual method of handling. Total weight of each unit, including load, 33,000 lb. — **Blaw-Knox Co., Pittsburgh, Pa.**

TUNNEL-TYPE EXCAVATOR for low headroom conditions as in tunnel driving, cutting underpass excavations through railroad embankments, under-trestle digging and like jobs. Overall height, 8 ft. Extreme width, 8 ft. Digging action centers in revolving manganese steel picks and paddles carried on extended tail shaft and powered by driving force of large motor. Will handle muck, clay, gravel and soft shale passing 1 1/2 to 1 3/4 cu.yd. of material a minute to bucket elevator which discharges on to short belt conveyor with 5-ft. reach beyond chassis frame affording full room for muck car in tunnel work. Equipped with bucket clean-out scraper for



working with sticky materials. Excavates trench cut up to 48 in. deep. Handles boulders up to 6 in. in diameter. Electric-motor driven. Self-propelling on creeper treads. Provides for knock down handling in passing machine down shaft for tunnel digging. — **George Haiss Mfg. Co., 391 Canal Place, New York City.**

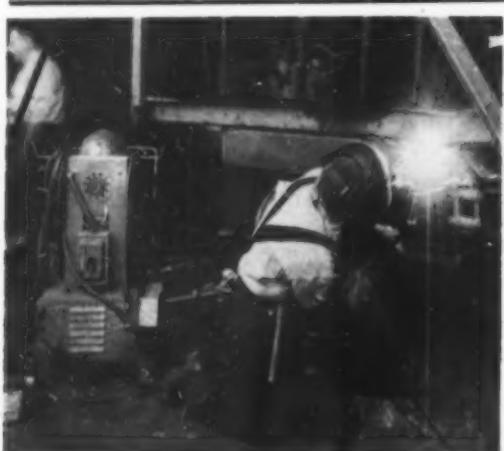


PORTABLE 2-IN. SELF-PRIMING CENTRIFUGAL PUMP stresses capacity, weight and eye appeal as outstanding features. Powered by Novo, streamline 2-hp. air-cooled engine and equipped with handles that form double protection for pump in case of rough handling, besides giving easy portability. Doughnut air wheel is standard equipment. Capacity, 6,000 g.p.h. at 10-ft. head and more than 4,100 g.p.h. at 25-ft. head. Constant-duty, bellows-type seal used. Weight, mounted on skids, 145 lb. — **Novo Engine Co., Lansing, Mich.**



DIESEL-POWERED DITCHER, four-cylinder 55-hp. Cummins diesel engine powers Buckeye wheel-type ditcher in California. Power furnished through Twin Disc clutch to crawler tracks, spoil conveyor and bucket wheel. — **Cummins Diesel Engine Co., Columbus, Ind.**

Construction Equipment News (Continued)



WELDER SPECIALLY INSULATED. Class B insulation at proper points insures against burn-outs of single-operator arc-welding machine with rated current range of 45 to 200 amp., driven by 7½-hp. a.c. motor, available for 60-cycle, 220 or 440 v., three- or two-phase power. Stationary model weighs 425 lb. Occupies floor space less than 2 ft. square. — **Lincoln Electric Co., Cleveland, Ohio.**



DIESEL ENGINE FOR SMALL SHOVEL is designed for operation of $\frac{1}{8}$ -, $\frac{1}{2}$ - and $\frac{1}{4}$ -cu.yd. machines of shovel, crane or dragline type. Torque characteristics meet heavy drag-down loads and stand up under fluctuations from no load to peak load in few seconds. Six-cylinder, four-cycle, light weight solid injection type unit, with $3\frac{1}{2}$ -in. bore, $4\frac{1}{4}$ -in. stroke and 275-cu.in. displacement, develops 33 brake hp. at 1,000 r.p.m. Compression ignition for starting and running. Glow plugs for cold weather starting. Net weight, with accessories, 1,085 lb. Maximum pressures are 625 lb. per square inch, lower than usual in diesel engines. Injection pressure is low and nozzles are large, non-clogging. Combustion system has controlled turbulence feature, producing accelerated burning and progressive rise in pressure. — **Buda Co., Harvey, Ill.**

OPEN-TYPE ALUMINUM FLOODLIGHTS. electric-powered, for use on night construction projects, strip mining and railroad classification yards when mounted not more than 275 ft. from area to be lighted. Also valuable for football field floodlighting where bleacher and grandstand requirements make it necessary to locate floodlights distance of 60 to 110 ft. back of side lines and yet provide high intensity illumination along far edge of field. Designed for mounting heights of 55 to 70 ft. Has special projector-shape reflector of Alzak aluminum. Section behind lamp is polished to produce con-



centrated beam of high candlepower to carry over considerable distances. Deflector located above lamp is also of Alzak aluminum. Four styles: Cross-arm for attachment to wood, cross arms and flat surfaces; pipe clamp for clamping around 1- to 2-in. pipe and pole cap to slip over end of $1\frac{1}{2}$ - or 2-in. pipe. Accommodates lamps from 750 to 1,500 watts. — **Benjamin Electric Mfg. Co., Des Plaines, Ill.**



FULL-REVOLVING CHAIN-CROWD SHOVEL for heavy duty in construction and allied fields is fully convertible and may be mounted on continuous tread crawlers or commercial truck chassis. Weight, equipped as chain crowd shovel with 10-cu.ft. (struck measure) dipper, 23,700 lb. Four travel speeds give range of 1 to 4 m.p.h. Rotating speed, 6 r.p.m. Powered with large six-cylinder, heavy-duty gasoline or diesel engine or electric motor. Fuel tank capacity, 54 gal. Independent swing and travel motions; chain crowd self-adjusting to all boom angles; A-frame and machinery deck of alloy steel each cast in one piece; friction steering and digging locks controlled from upper deck at operator's position; crowd brake; live boom hoist; power dipper trip; easily operated controls. — **The Osgood Co., Marion, Ohio.**



IMPROVED RAILWAY TRACK built of keystone-shaped wood cross ties laid in same manner as rectangular ones. Concrete then is poured into cribs interlocking with ties to form continuous, uniformly semi-resilient load distributing base over entire subsoil surface. Advantages claimed: (1) can be constructed under traffic; (2) precludes use of heavy rails; (3) reduces equipment maintenance; (4) minimizes rail corrugation and traffic noise; (5) prevents track and paving depression; (6) provides for paving and rail impact; (7) assures uniform resiliency; (8) costs less to build and maintain than any other track of equal load carrying capacity. — **Keywood Railway Tie Co., Box 25, Walbrook P.O., Baltimore, Md.**

News from Manufacturers

ABOUT THEIR PRODUCTS

The publications, reviewed below, will keep you posted on latest developments in construction equipment and materials available for your use.

SPEED PATROL GRADERS — **Allis-Chalmers Co., Tractor Division, Milwaukee, Wis.** (30 pp., illustrated). Describes complete line of machines and presents action photographs of units operating under various conditions. Features of patrols described and illustrated. Several pages devoted to tandem drive models available either in 4 or 8 wheel assemblies and with a choice either of gasoline, distillate or diesel fuel burning engines. Detailed description of controlled ignition diesel fuel engine and tabulation of full specifications for both single and tandem drive machines.



PORTABLE ELECTRICAL CABLE — **General Cable Corp., New York, N. Y.** (32 pp., illustrated). Cable protected by rubber jacket vulcanized under pressure resists abrasion and tear. Each conductor composed of multiple strands of fine, annealed, bare or tinned copper wire, rubber-insulated, protected by cotton braid or rubber-faced cotton tape, cushioned by cotton or jute fillers, wrapped with twine and covered by vulcanized jacket. Single-, two-, three- and four-conductor cables for 600-v. power; high-voltage cables up to 7,000 v.; and concentric and parallel-duplex cables for mining and hard service.

SLING CHAINS — **American Chain & Cable Co., Inc., Bridgeport, Conn.** (8 pp., illustrated). Specifications and tables of safe working loads for chain sizes from $\frac{1}{8}$ to 2 in. Covers single, double and multiple-leg clangs equipped with rings, pear-shaped end links, sling hooks and grab hooks. Also dredge or iron crane chain. Cautions and instructions on purchase and use of chain.

ROAD GRADERS — **J. D. Adams Co., Indianapolis, Inc.** (16 pp., illustrated). Condensed catalog covering new line of leaning-wheel graders, heavy-duty motor graders, and retread pavers for bituminous work. Largest graders have 12-ft. blades and either power or hand control. Latest addition to line is No. 20 low-priced motor graders with 9-ft. blade powered by 22½-hp. engine for township or light county road maintenance. Elevating graders have new plow beam design and independent power units for operating carrier and controls. Retread paver has four sets of mixing blades and adjustable rear spreader blades.

STORE FRONTS — **Zouri, Niles, Mich.** A portfolio (8½x11 in.) of 15 store-front designs, illustrating use of Zouri rustless metal rolled and heavy extruded construction, together with information on moldings and sections for complete store front.

RIVETING ALUMINUM — **Aluminum Co. of America, Pittsburgh, Pa.** (35 pp., illustrated). Treatise on methods of joining aluminum and its alloys by riveting, where resistance to corrosion and saving of weight are essential. Strength of riveted joints. Types of rivet heads and proportions of riveted joints. Cold driving methods with squeeze riveter. Selection of rivet alloy. Table of weights for aluminum alloy rivets.

STEEL SWIMMING POOL — **Pittsburgh-Des Moines Steel Co., 3423 Neville Island, Pittsburgh, Pa.** (4 pp., illustrated). Brief description, illustrated, of all-steel tank construction; with welded joints to insure watertightness. Steel surfaces protected with water-resistant paint. Cross-section shows design details.

ROOFING AND WATERPROOFING — **Koppers Co., Pittsburgh, Pa.** (36 pp., illustrated). Detailed specifications for 3-, 4- and 5-ply tarred felts on roof decks of different types, including wood, concrete, gypsum, tile and steel. Water-cooled roofs for air-conditioned buildings. Detailed drawings of waterproofing insulation, flashing. Wall waterproofing, damp-proofing and termite-proofing by pitch method. Data sheets on membrane waterproofing for foundations, swimming pools, sidewalk vaults.



PNEUMATIC TOOLS—Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. (Two catalogs, both illustrated: No. 40, 12 pp.; No. 50, 50 pp.). Thor mining and contractors' tools—rock drills, stoppers, drill mountings, paving breakers, trench diggers, clay diggers, concrete surfacing grinders, sump pumps, rotary drills, rotary grinders, reversible wood boring machines, rotary brush, one-man rivet busters, air-motor hoists, holders-on (for riveting), rotary screw drivers, tapping machines, wrenches, hammers for scaling, riveting, chipping and caulking. Also electric tools.

LUBRICATION PANORAMA—Shell Petroleum Corp., Shell Building, St. Louis, Mo. (Series of booklets, each 25 pp., illustrated). Non-technical information, with clarifying sketches and diagrams, on the manufacture and application of lubricants. Subjects of first three booklets published are: (1) Fundamentals of Lubrication; (2) Lubricating Friction Type Bearings; (3) Modern Motor Oil. Facts about friction and its reduction by lubrication. Viscosity of oil and selection of correct lubricant. Descriptions of types of bearings, including bearing materials and construction. Lubricating bearings. Summary of oil lubricating systems. Oil groove design and location. Industrial lubrication chart. Progress of motor oil refining. Sources and nature of crude oils. Manufacturing processes described in detail. Laboratory and road tests. Technicalities are avoided and a selection of simple drawings makes clear the points covered in the text of all three booklets. The Shell organization maintains a staff of lubrication engineers whose services are available for consultation and advice on lubrication problems.

LEGAL TRUCK SIZES AND LOADS—Fruehauf Trailer Co., Detroit, Mich. Convenient pocket slide rule device indicates for each of 48 states legal limits for truck and trailer widths, lengths, heights, gross weight per axle and gross weight for truck and trailer combinations. Also data on tire capacities. Formulas are given for states where computation of legal limits is necessary. Information is useful for shipment of bulky or heavy loads.

RUBBER HOSE—U.S. Rubber Products, Inc., 1790 Broadway, New York. (48 pp., illustrated) three fundamentals of hose construction include tube, carcass and cover, adapted to service requirements. Wide range of types embrace Royal cord, wrapped duck, woven jacket and braided hose for water, air, steam, oil and gas. Tables of sizes and working pressures. Special "giant" sand-suction hose, with abrasion-resistant tube, for dredging. Flexible dredging sleeves. A section is devoted to hose couplings and fittings. Services of company's engineers and chemists for solving hose problems of contractors and engineers are available upon request.

STRUCTURAL INSULATION—Celotex Corp., 919 N. Michigan Ave., Chicago, Ill. (28 pp., illustrated). Manufacture and applications of cane board, made from bagasse, vegetable fiber waste from sugar cane. Descriptive matter on properties of Celotex, insulating value, structural strength, moisture resistance. Tabulation of sizes and major uses of building board, lath, roof insulation, concrete form board, tile board, hard board, etc. Suggestions for applying Celotex as roof insulation. Detailed drawings of applications to frame construction. Specifications for wall sheathing, exterior and interior wall finish, plaster base, building board, roof insulation, etc. Also uses of Celotex for acoustical service.

ROAD BUILDING EQUIPMENT—Austin-Western Road Machinery Co., Aurora, Ill. (24 pp., illustrated). A pictorial catalog featuring blade and elevating graders, rollers, shovels and cranes, scrapers, cars, wagons, crushing plants, rippers, snow plows, bituminous distributors. Details of perfected hydraulic power control for machine operation. Brief specifications and reference data. Numerous photographs illustrate application of machines in actual service.

WELDING VARIOUS METALS—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. (100 pp., illustrated; price, 50¢). "How to Weld 29 Metals" contains general information and tables with sectional drawings giving recommended welding procedure for various joint designs. Welding low-, medium- and high-carbon steels; 3½ nickel steels; 4-6 chromium steels; Cromansil, Man-ten, Cor-ten, Yoloy and R.D.S. steels, chrome-vanadium, chrome-molyb-

denum and manganese-vanadium steels; stainless steel; cast and malleable iron; aluminum; copper; Everdur, Herculoy and Monel metal; nickel, bronze and brass.

ROAD-BUILDING EQUIPMENT—Barber-Greene Co., Aurora, Ill. (51 pp., illustrated). Trends in low-cost bituminous highways summarized with regard to mechanical handling of materials, as preface to detailed descriptions of traveling bituminous mixing plants, bituminous finishers, bucket and belt loaders, conveyors, bucket elevators, feeders, vibrating screens, ditchers and snow-loading machines. Self-powered travel plant in heavy duty and lighter county models, picks up windrowed aggregate from subgrade with bucket elevator, mixes it with bituminous material in twin pug-mill and replaces it for spreading and finishing. Numerous photographs show applications of equipment in road-building service. Notes on plant operation, performance and types of materials handled. Belt conveyors for unloading cars and barges, excavated earth, wet concrete and aggregates at central mixing and batching plants. Ditcher is of vertical boom and bucket type.

WELDING OPERATOR'S TEXT—Lincoln Electric Co., Cleveland, Ohio. (128 pp., mimeographed, illustrated by sketches; price, 50¢.) "Lessons in Arc Welding" covers arc-welding machine, its operation and control; shielded arc and its uses; striking arc; running horizontal bead; running bead 12 in. or more in length; weaving electrode; effect of arc length, current and speed on bead; various types of electrodes; padding and building up plates; building up shafts; butt, lap, tee, vertical and horizontal welds; overhead welding; expansion and contraction; penetration and cutting; welding mild, light-gage, high-tensile, stainless and 4-6 chromium steels, cast iron, aluminum, bronze and copper; hard-facing various metals.

POWER SHOVEL, CRANE—Bay City Shovels, Inc., Bay City, Mich. (8 pp., illustrated). Complete specifications for $\frac{3}{4}$ - and $\frac{1}{2}$ -yd. models of full-revolving shovels, 4-ton capacity cranes and draglines. Design features emphasized are helical cut alloy gears, chain crowd, swing lock for revolving table, automatic crowd chain adjustment, unit-cast car body and machinery table, drop-forged crawlers. Tabulated data on working ranges and clearances for shovel and dragline. Table of safe working loads for crane with 25- and 30-ft. booms. Weights are 21,000 lb. for $\frac{3}{4}$ -yd. size and 23,600 lb. for $\frac{1}{2}$ -yd. size.

CRUSHING AND SCREENING—Iowa Manufacturing Co., Cedar Rapids, Ia. (12 pp., illustrated). Tandem, straight-line, portable plants for aggregate production. Crushing, screening and gravel-washing equipment.

BATTERIES—B. F. Goodrich Co., Akron, Ohio. (24 pp., illustrated). Kathodone construction in two batteries for light trucks and in seven for heavy-duty service uses flexible, porous spun-glass mats to hold active material in positive plates for longer than ordinary period. Other batteries described use slot-ted rubber separators. Battery specifications, battery power requirements for trucks and buses and battery replacement data for trucks, tractors and buses.

BITUMINOUS DISTRIBUTORS—Kinney Mfg. Co., 3529 Washington St., Boston, Mass. (12 pp., illustrated). For applying asphalt or tar to road surface. Range of tank capacities from 350 to 1,250 gal. Details of design and construction cover rotating plunger pump, engine, oval tank, oil-burner heating system, insulation, spray bars and nozzles, and controls. Specifications, dimensions and weights for all models. Hand attachment for spraying at distance from tank-truck.

FLOW METERS—Brown Instrument Co., Philadelphia, Pa. (56 pp., illustrated). Covers complete line of indicating, recording and integrating flow meters in both electrical and mechanical types. Used for measuring steam, gas, air, water and other fluid materials. Applications in waterworks, hydroelectric plants, irrigation, filtration systems, gas works and industrial service, for determining efficiencies of men and machines, checking labor and material and reducing service interruptions and operating costs.

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Pennsylvania R. R. Bridge over Wills Creek, Kimbolton, Ohio



News from Manufacturers

ABOUT THEIR PRODUCTS

The publications, reviewed below, will keep you posted on latest developments in construction equipment and materials available for your use.

MECHANICAL RUBBER GOODS—B. F. Goodrich Co., Akron, Ohio. (28 pp., illustrated). A buyer's guide, with list prices, to more than fifty mechanical rubber products and accessories of the company's Diamond division, including transmission and conveyor belting, hose and fittings, tubing, packing, cements, valves and matting. Tables list horsepower capacity and minimum pulley diameter for belts of various sizes and plies, general data pertaining to selection and installation of conveyor or belting for different types of service and facts about hose construction and application.



JACKS AND TRENCH BRACES—Joyce-Cridland Co., Dayton, Ohio (4 pp., illustrated). Lifting equipment includes locomotive screw jacks with positive diamond-tread, non-slip safety top, in capacities from 6 to 20 tons; bell base screw jacks of six-way head, ratchet type (capacities 15 to 35 tons); cast-iron screw jacks for house moving and industrial use; heavy-duty steel shoring jacks (capacities 25 to 50 tons); house-raising jacks (capacities 20 to 45 tons); and trench braces for widths of from 22 to 70 in. Tables of specifications and list prices.

CONCRETE CURING—Dow Chemical Co., Midland, Mich. (4-p. folder, illustrated). How admixture of calcium chloride in concrete shortens curing period and improves workability of mix and develops early strength, particularly under conditions of cold weather. Refers to detailed information in new booklet "How to Cure Concrete with Dowflake."

STABILIZED ROADS—Calcium Chloride Association, Penobscot Building, Detroit, Mich. (85 pp., illustrated). Technical manual on low-cost road stabilization with aggregates, binder soil and calcium chloride. Includes chapters on specifications, design of mixture and computation of quantities, construction methods and maintenance. Covers both road mix and plant mix types. Profusely illustrated with charts, photographs and tables. Practical and serviceable information for highway engineer and contractor on design, construction and maintenance of stabilized roads. In addition to data on procedure, manual contains bibliography of outstanding articles and reports on road stabilization.



MATERIALS-HANDLING MACHINERY—Gifford-Wood Co., Hudson, N. Y. (112 pp., illustrated). Applications cover equipment for mechanical handling of raw materials in bulk, packaged goods, power plant equipment, aggregate handling, ice handling, retail building materials and coal yards. Belt conveyors, bucket elevators, screw conveyors, etc. Diagrams of typical arrangements. Tabulated data on capacities, speeds and weights. Gates for bins and hoppers. Book is designed to aid consulting engineers, plant owners and managers in selecting proper material-handling equipment for industrial and other installations.

POWER PUMPS—Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill. (12 pp., illustrated). Characteristics and applications of duplex power pumps. Self-oiling power end and valve deck type fluid end in two complete lines: Standard general service pumps in sizes of $2\frac{1}{2}$ to 3 in. by 4 in. and $2\frac{1}{2}$ to 6 in. by 6 in., with capacities to 215 g.p.m. at pressures to 250 lb. Heavy-duty pumps, in sizes of $2\frac{1}{2}$ to $3\frac{1}{2}$ in. by 4 in. and 3 to 4 in. by 6 in., have capacities to 93 g.p.m. at pressures to 500 lb. Belt drive with tight and loose pulleys, chain driven by top-mounted motor, tandem-mounted motor and Flex-Mor V-belt drive, and gasoline engine. Pumps can be adapted to various service demands by changing size of pistons and removable liners, and using special valve services, piston packings and construction materials.

Page 78

SILENT CHAIN DRIVE—Link-Belt Co., Chicago, Ill. (96 pp., illustrated, fabrikoid binding). Positive power transmitting and mechanical handling with Silverstreak silent chain drives, from fractional horsepower up to 2,000 hp. No slippage. Suggestions for performance check-up to cut production costs. Installation pictures. Engineering data for selection of silent chain drives. Recommended drive selections, up to 2,000 hp., in tabular form. Lubrication. Dimensions of chains and component parts tabulated. List prices. Drive accessories. Electrical and miscellaneous data. Details of full line of positive drives.

CONCRETE MACHINERY—Ransome Concrete Machinery Co., Dunellen, N. J. (26 pp., illustrated). Condensed pocket edition catalog of line of concrete mixers ranging from small $3\frac{1}{2}$ -S tilting model to large 27-E single and dual-drum pavers and 126-S building mixer for central plant operation. Either steel or rubber-tired wheels for portable building mixers. Increased production with dual-drum unit, which nearly halves mixing time. Mast and tower pavers for chuting concrete. Mechanical strikeoff for concrete pavement. Masts, towers and chutes, hoist buckets, hoppers, concrete carts. Pneumatic concrete placers in $\frac{1}{4}$ -, $\frac{1}{2}$ - and 1-cu.yd. sizes for tunnel and subway lining. Pneumatic grout mixer and placer.

MODERN TIMBER STRUCTURES—Timber Engineering Co., 1337 Connecticut Ave., Washington, D. C. (12 pp., illustrated). Teco timber connectors for making strong joints in modern wood framed structures. Connector types include toothed ring, spike grid and clamping plate, placed between timber faces and imbedded with bolts passing through the assembly. Also split ring connectors (placed in pre-cut grooves) and shear plates. Illustrations show detailed methods of installation. Wide range of applications listed.

HOW TO WELD 29 METALS—Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. (100 pp., illustrated; price 50¢). A comprehensive book "How to Weld 29 Metals," covers procedure, conditions and materials for welding modern alloys. For welding all types of joints with varying thicknesses of metal, specific data on electrode diameter, welding current, speeds, and deposition. Prepared by Charles H. Jennings, the company's engineer in charge of welding research. The book should be of value to welding operators in simplifying and improving the welding of present day metals and alloys.

ARC-WELDING CONTEST—The James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio (48 pp., illustrated). Rules and conditions for contest to encourage and stimulate scientific interest in the study of arc-welding, with 446 prizes, aggregating \$200,000, for papers in 44 sub-classifications. Grand prize of \$13,700. Work described in papers should be product of Company or firm with which contestant is or has been connected. Subject matter of papers must relate to (1) redesign of existing machine, structure or building; (2) new design; or (3) organizing, developing and conducting a welding service. Structural classification includes buildings, bridges, houses and miscellaneous. Other classifications cover railroads, automotive, industrial machinery, etc. Contest closes July 1, 1938. Brochure gives detailed explanation of classification of subjects for contest papers.

TAR HANDBOOK—Koppers Co., Pittsburgh, Pa. (63 pp., pocket size). Complete tables and useful general information on use of Tarmac for road construction and maintenance. Soil stabilization with tar. Condensed specifications for various methods of using road tars. Tabulated data on quantity and coverage of tar for various road widths, tons and cubic yards of aggregate per mile, stock pile spacing of tar.

EXPLOSIVES—Atlas Powder Co., Wilmington, Del. (44 pp., illustrated). Tables give characteristics of high explosives and weight in pounds of dynamite per foot of bore holes of various diameters. High explosives, special quarry explosives, permissible and agricultural explosives, low powders, low explosives, electric blasting caps and blasting machines, squibs, safety fuse and blasting caps, accessories.

ROLLED MANGANESE STEEL—Manganese Steel Forge Co., Philadelphia, Pa. (28 pp., vest pocket size). List of applications of abrasive-resistant Roll-Man metal with tensile strength of 140,000 lb. per square inch, a Brinell hardness number of 200, and an elongation of 35 to 50 per cent in 2 in. Machine parts can be duplicated in this material for longer service life. Among applications to construction equipment subjected to unusual wear are chutes, grizzly bars, screens, blades for graders, buckets (excavating and conveyor), chain, liners for concrete mixers, rock crushers, shovel dipper-teeth, doors and lips, gates and hoppers.

DIESEL POWER UNITS—Fairbanks-Morse & Co., 900 South Michigan Ave., Chicago, Ill. (16 pp., illustrated). Model 36 diesel offered in two cylinder sizes and in various combinations, with rating as low as 10 hp. is smallest in complete line of Fairbanks-Morse diesels. Available as a completely inclosed power unit, mounted on skids and with radiator, hood and fuel tank for exposed installations; mounted on a cast-iron base with or without clutch and reduction gears for a stationary use; and as a basic power unit for installation in portable or semi-mobile industrial and construction equipment. Medium high speed, four-cycle diesel. Construction details include many sectional views and illustrations of parts.

MOBILE DRILL RIG—Worthington Pump & Mchly. Corp., Harrison, N. J. (12 pp., illustrated). Rock drill mounted on light tubular carriage with two pneumatic-tired wheels. "Rockmaster" rig is collapsible for towing and is flexible in adjustment for varied setups. Recommended for holes not exceeding 18-ft. depth in down-hole, line, hillside, breast, side-hole and snake-hole drilling.

WELDING PIPE LINES—Linde Air Products Co., New York, N. Y. (32 pp., illustrated). Covers improved "Lindewelding" method used in constructing more than 5,000 mi. of cross-country pipe lines, emphasizing economy and rapidity of installation, joint design, quality and strength of welds and simplicity of field operations. Other subjects covered are the growth of pipe line welding since 1914, time and material records on typical Linde-welded lines, construction organization and methods, welding specifications, welding rod and technique, metallurgical considerations, multi-flame welding, and the all-bell-hole method. A list of oxy-acetylene welded lines laid since 1917 includes many well-known oil, gas and gasoline pipe lines.

MARINE MARKER EQUIPMENT—Westinghouse Electric & Manufacturing Co. (Lighting Division) Cleveland, Ohio. Construction, dimensions, and applications of marine marker equipment including draw-bridge markers, duplex lift-bridge markers, and duplex bascule-bridge markers. Requirements for installation, equipment needed and wiring diagrams are included.

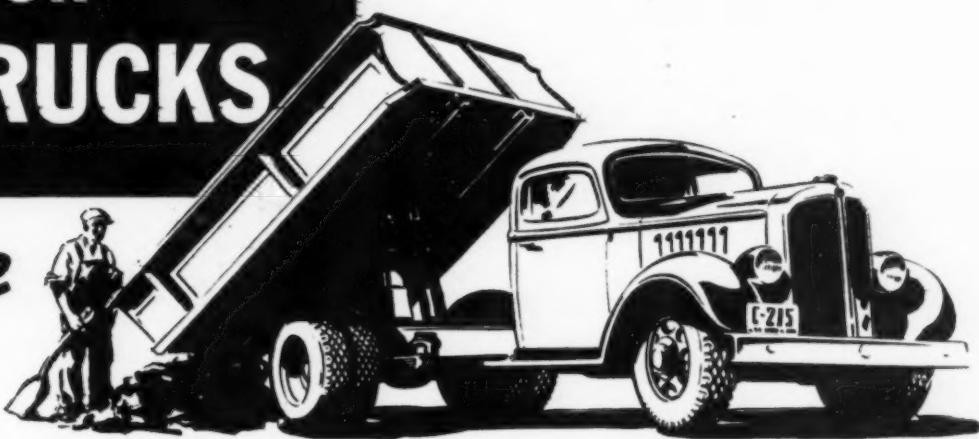
MIXERS—Jaeger Machine Co., Columbus, Ohio. (36 pp., illustrated). Machined steel tracks, fast charging and discharging, accurate water control, oversize engines, and automatic batchmeters for 7S and 10S two-wheel pneumatic-tired trailers or four-wheel steel-tired side-discharge mixers; 14S side-discharge unit on four wheels (steel or solid-rubber tires) or on skid mounting; 28S and 56S plant mixers with automatic skip shakers. Also, end-discharge truck mixers in capacities of 1, $1\frac{1}{2}$, 2, 3, 4 and 5 yd., and side-discharge truck mixers in $1\frac{1}{2}$ - to 5-yd. sizes; 31/2S, 5S and 7S tilting mixers; 6-cu.ft. plaster-mortar mixer with or without hoists; cold-patch mixers in 6- and 10-cu.ft. sizes; 11-cu.ft. pneumatic-tired and 61/2-cu.ft. steel-tired concrete buggies; bottom-dump concrete buckets of 36- to 118-cu.ft. water-level capacity.

JACKBITS—Ingersoll-Rand Co., Phillipsburg, N. J. (28 pp., illustrated). Characteristics and uses of detachable heat-treated steel bits to reduce rock drilling costs. Special thread, with no deep or sharp undercuts, makes bits easy to put on and take off drill rods. Can be resharpened three times. Blow of drill piston is transmitted squarely to cutting edge through full area of rod; no portion of blow is transmitted through threads of Jackbit. Five types of bit in wide range of sizes. Tables show dimensions and prices. Instructions for threading drill rods to receive detachable bits.



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of these



3 GREAT TIRES



• Tires on Dump Trucks take a beating wherever they work. So Goodyear builds every one of its Dump Truck Tires on a tough sturdy body—of patented pre-shrunk Supertwist Cord and chemically-toughened rubber with blowout protection in every ply.

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THE most exacting basis for
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measurement, is based not
on the service of a single rope
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Atlas Gelodyn gives—

- Gelatin performance at lower costs.
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Under all save extraordinary moisture and ventilating conditions Atlas Gelodyns, semi-gelatinous type explosives, offer attractive economies in Tunnel, Highway and Construction blasting.

Atlas Gelodyns are suitable for wet work where ordinary dynamites could not be used effectively. Gelodyns are sufficiently plastic to be

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And—Atlas Gelodyns, more bulky than true Gelatin type Dynamites, offer higher cartridge counts and higher strengths.

Ask the Atlas Representative to consult with you. He may be able to show substantial savings for you with Atlas Gelodyns.

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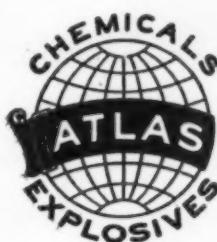
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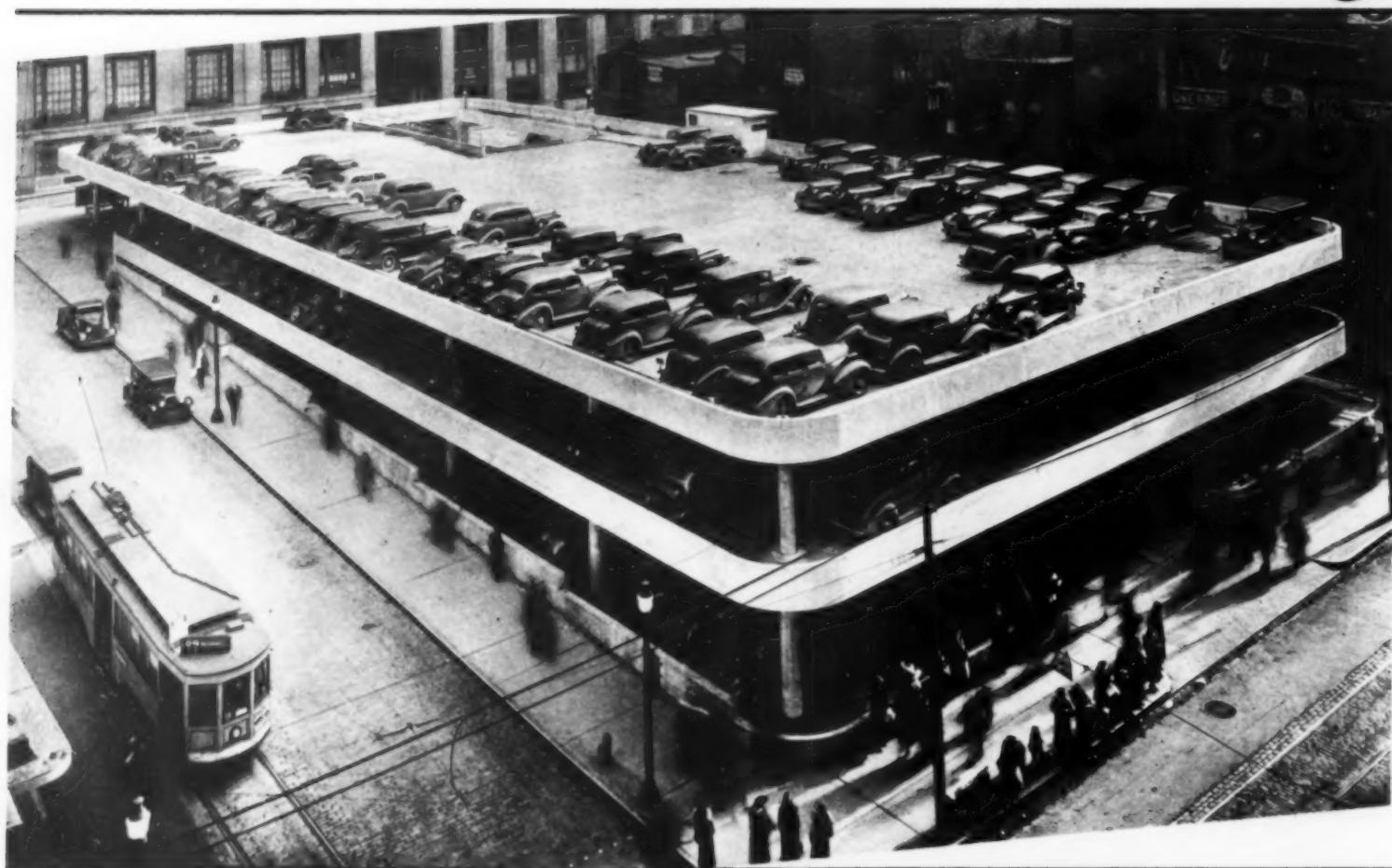
Pittsburgh, Pa.
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This Quick answer to "No Parking"



increased Kaufmann's business

LEHIGH EARLY STRENGTH CEMENT

"Time is the Essence of this Contract." Mellon-Stuart Company, contractors, and Metzger-Richardson Company, designers, had this to contend with when erecting this three-story concrete "parking lot" in Pittsburgh. Kaufmann's Department Store wanted it ready for the holiday shopping trade. Both designers and contractors knew, if they used normal portland cement, that the usual "waiting time" for concrete to harden to service strength would delay the opening. The time factor was met by using quick service concrete, made with Lehigh Early Strength Cement, in the floors. 20 days sooner than would have been otherwise possible, cars were parked on the 1st and 2nd floors—and on the top tier, 2 days after pouring the slab. All told, 27 days were saved and the floors were watertight. Incidentally, the contractors removed the 2nd floor forms in time to use them for the 3rd floor—reducing form costs.

Contractors are using Lehigh Early Strength Cement everywhere to get unusual results in concrete construction. Compared to normal portland cement, it makes concrete of equal strength in one-third to one-fifth the time. Often—aside from time saving—it reduces construction costs; it saves on form expense, heat-curing expense in cold weather, and job overhead.

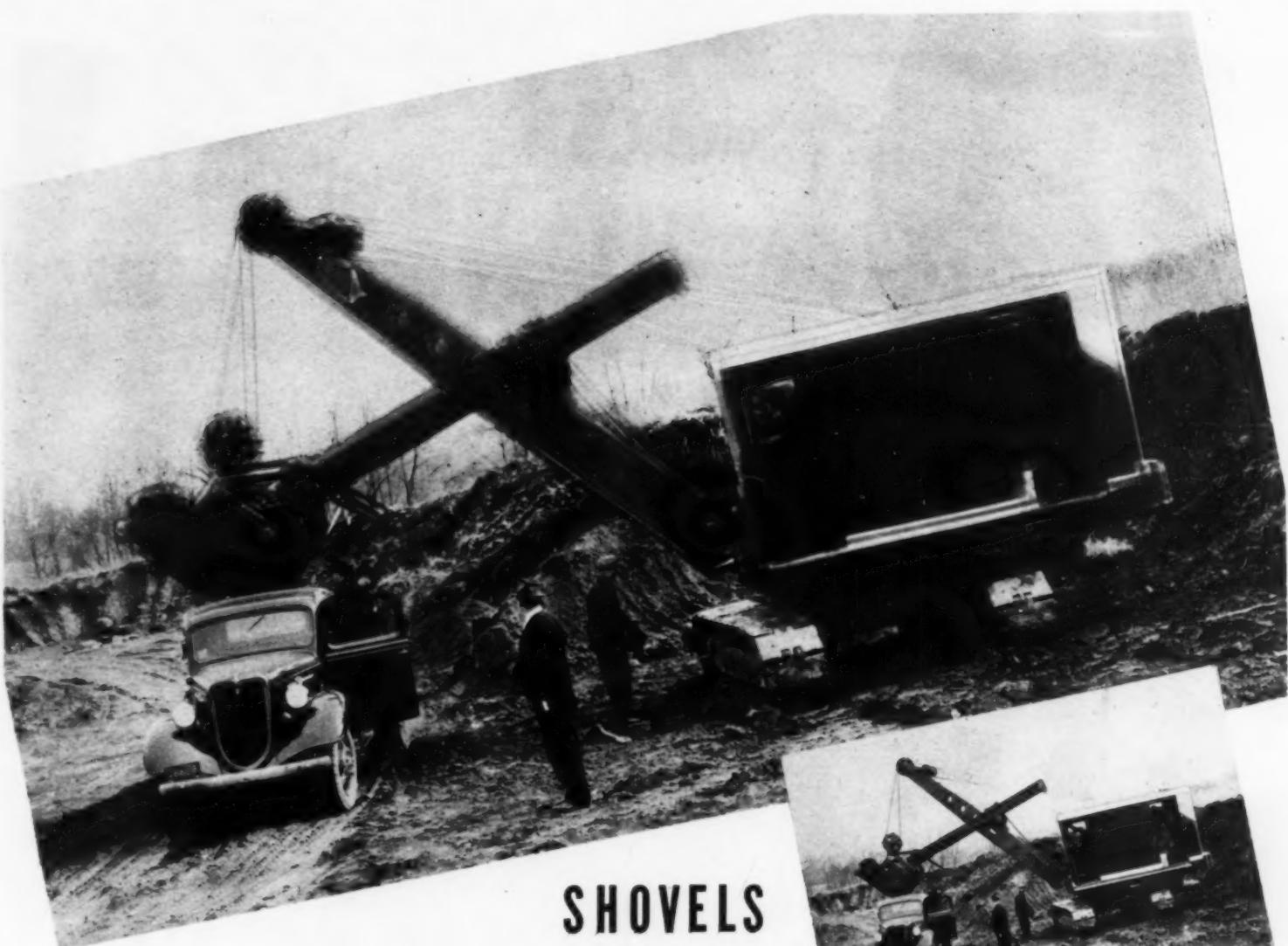
Write for copy of 32-page book, "Lehigh Early Strength Cement—What it is, what it does, and what it can be used for"



Look for the Red Arrow

LEHIGH
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LEHIGH PORTLAND CEMENT COMPANY
Allentown, Pa., Chicago, Ill., Spokane, Wash.



SHOVELS

HAVE "CHILLS AND FEVER" TOO

but

NOT WHEN EQUIPPED WITH CUMMINS DIESEL

• A rough running engine can give your shovel "chills and fever" . . . excess shivering and chattering as it digs and crowds. Rough running is often transmitted to every working part . . . it means extra wear in engine and transmission. The Cummins Diesel is smooth running . . . no vibration

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CUMMINS DIESELS
Pioneers in Modern Diesel Development



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"The Dependable Diesel"
76 pages of Diesel news,
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CONSTRUCTION MACHINERY
IS FACTORY-EQUIPPED FOR
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**Alemite System Guards Expensive Bearings
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clean lubricant to every part of the bearing surface.

Here's a Pioneer Jaw Crusher, working with a Secondary Roll Crusher, Folding Bucket Elevator, and Horizontal Gradation Screen to make three sizes of crushed limestone on a county project in La Crosse County, Wisconsin. There's flying limestone dust everywhere—*except inside the bearings!*

See how easily, in the small photo, lubricant is applied to the Alemite Fitting with the Alemite Gun! It's the clean, quick, *safe*

IT doesn't take much grit—in a bearing that's carrying tons of pressure—to ruin that bearing in short order. That's why Pioneer Gravel Equipment Mfg. Co. puts Alemite Fittings on *every* bearing on *every* piece of Pioneer construction machinery. Because they know these fittings are sealed against dust and grit, opening only under the pressure of Alemite Guns to admit

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method—*used on more than 95% of all modern construction machinery!* Bring your older equipment up to date—safeguard your expensive bearings—and cut down lubricating costs, by replacing oil holes and grease cups with modern Alemite Fittings! This can be done quickly, at small cost, without delaying the job! Mail the coupon today for your FREE copy of our new manual, "Alemite Controlled Lubrication."

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**BYERS COMPLETE LINE
OF SHOVELS AND CRANES**

Bear Cat Jr.	$\frac{3}{8}$ Yd. ($\frac{3}{4}$ swing)
Model 55	$\frac{3}{8}$ Yd.
Model 62	$\frac{1}{2}$ Yd.
Model 66	$\frac{5}{8}$ Yd.
Model 80	$\frac{3}{4}$ Yd.
Model 100	1 Yd.
Model 125	$1\frac{1}{4}$ Yd.

● Here's what 150 Bear Cat Junior owners say their average daily operating costs amount to . . . for every chargeable expense:

9 Gallons Gasoline per 8 hr. day at 14c per gal.	\$1.26 per day
Oil change every 6 days13 per day
Grease10 per day
Depreciation (5 year period)	2.16 per day
Interest on investment 6% (5 years)63 per day
Repairs, Figuring 200 wk. days87 per day
Total Daily Operating Cost	\$5.15 per day (not including operator)

You can't beat it for low costs! You'll make extra money with the Bear Cat Jr. because it costs so little to move this $7\frac{1}{2}$ ton machine from job to job. Move it on its own low cost 2-axle trailer. No trouble, no delay, no extra expenses involved in moving.

Write for the booklet "Bear Cat Jr. Facts" which completely describes this big money making, independent crowd $\frac{3}{4}$ swing shovel.

THE BYERS MACHINE CO. • RAVENNA, OHIO

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Revolving Scrapers

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Regular Rippers

Road Discs, or Planers

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A TIME-TRIED economical maintenance tool to remove "corduroy" or waves from asphalt macadam or oiled roads. Does not disturb road base. A skid reducer and effective ice cutter. Width of cut is 48". Has accurate

spring-balanced patented control, unaffected by vibrations. Easy to operate. Weight 7450 lb. Sold by "Caterpillar" distributors everywhere. Write for folder. Killefer Mfg. Corp., Ltd., Los Angeles, California; Peoria, Illinois.



Sold by "Caterpillar" Distributors everywhere. Killefer Mfg. Corp. Ltd., Los Angeles, Cal., Peoria, Ill.

4-B Road Disc, or Planer

Check the Advantages of BLAW-KNOX TRUKMIXERS



DEPENDABLE PERFORMANCE



QUALITY CONCRETE



MAXIMUM PROFITS

You will obtain a greater share of the concrete business and profit for your plant with Blaw-Knox TRUKMIXERS and Agitators because they mix concrete faster and better.

We would like to tell you why Blaw-Knox Trukmixers not only get business and profits for you, but save you money in low depreciation and maintenance costs.

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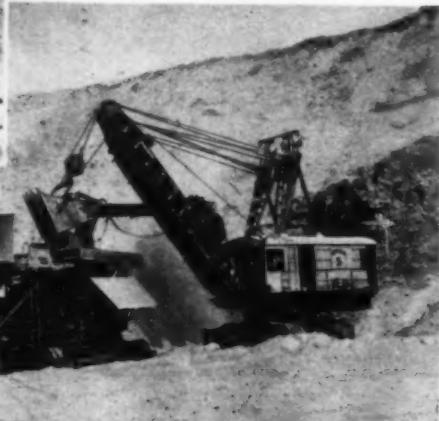
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13,000,000 TONS

Two of six electrically operated shovels which excavated 52,000 cubic yards per day at Grand Coulee Dam. Mason-Walsh-Atkinson-Kier Company, contractors



Getting Down to Bedrock with Shovels Powered by General Electric

PREPARATION of the foundation site for this 4000- by 500-foot dam required the excavation of more than 13,000,000 cubic yards of overburden.

To excavate this huge quantity of earth, the contractors called for six electric shovels. They specified shovels electrically equipped by General Electric. Fast work, 24-hour availability, and ease of operation are conspicuous advantages to the contractor who uses G-E equipped shovels.

The electric shovels at Grand Coulee set the pace for a mile-long conveyor system. They were instru-

mental in making possible the record removal of 52,000 cubic yards of spoil per day. Excavation was completed far ahead of schedule.

Electric shovels, conveyors, crushers, concrete batchers, compressors and pumps—these are typical of the machinery for which General Electric furnishes modern apparatus to assure speed and economy in completing the job. For information on any type of electric apparatus, get in touch with the General Electric office in your territory, or write General Electric, Schenectady, N. Y.

**TO GET SPEED FOR THE JOB, COMPLETE SERVICE FOR
YOUR MONEY, SPECIFY GENERAL ELECTRIC EQUIPMENT**

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Just ask JOHN KERNS CONSTRUCTION CO. about



Get acquainted with Super-Harbord now . . . there are plenty of contractors who are cutting plenty of costs with Super-Harbord.

Contractors all over the country have been re-using Super-Harbord Plycrete Panels from 8 to 30 times, but here's a construction man who shows what these WATERPROOF panels will actually do. Read his letter — it simply radiates cost-cutting and satisfaction.

Super-Harbord, as many contractor-users know, is hot-pressed with a resinoid bond absolutely insoluble to water — guaranteed against *ply separation*. In every respect it is superior to ordinary lumber. It knocks the spots off costs of erecting all concrete structures including bridge piers and docks, retaining walls, spandrels, stair beams, and floors because:

- 1 More . . . More . . . more re-uses due to waterproof qualities and harder surfaces.
- 2 Large panels make forms go up faster.
- 3 Smoother surfaces and tight joints save costly rubbing and finishing.
- 4 Super-Harbord gives more strength under stress and strain.

JOHN KERNS CONSTRUCTION CO.
Contractors of Public Works

OMAHA, NEBRASKA February 6, 1937

HARBOR PLYWOOD CORPORATION,
REEDER, WASHINGTON.

Dear Sirs:

We recently completed the Sutton Creek Plant Wall P.T. Project No. 2000-4 at Council Bluffs, Iowa.

This work contained the building of 11,000 lin. ft. of 30 ft. wide and 12 ft. high wall. We purchased from you company 10,070 feet of Super-Harbord Plycrete, which made into panels 47 x 107, and re-erected these into 47 x 30', a total of 600 lin. ft. of 47 panels.

As you can readily see this material was used for 60 to 80 times. This project was completed using the Plycrete Panels to build stairs, abutments, concrete piers and show no signs of ply separation and in our opinion will last until it is completely worn out.

We not only recommend Harbor Super-Plycrete for new material for its many reasons, but it leaves a smooth finish which takes very little if any painting.

We have no hesitation in recommending Harbor Super-Plycrete to be the most economical concrete form material.

Very truly yours,

JOHN KERNS CONSTRUCTION CO.
John T. Kerns.

SUPER-Harbord

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Mills and General Offices Hoquiam, Wash.
Communications addressed to Harbor Plywood Corporation in any of following cities will receive prompt attention:

BRANCHES — Atlanta, Chicago, Indianapolis, Milwaukee, Philadelphia, Pittsburgh, Cincinnati, Louisville, Jacksonville, New Orleans. REPRESENTATIVES — Cleveland, Columbus, Toledo, Baltimore, Washington, D. C., Worcester, Kansas City, Omaha, San Francisco, Los Angeles, Billings.

... WHEN YOU NEED A TOUGH STRONG WRENCH

USE THE
FAVORITE REVERSIBLE RATCHET WRENCH

IT NEVER LEAVES THE NUT UNTIL OPERATION IS COMPLETED.

On work such as shown in illustration it is very essential that the wrench be constructed of materials that will stand up under the terrific strain of bolting these timbers together.

The "Favorite" has been selected by the contractors as being worthy of doing a splendid job.

The action is fast and continuous.

Two different-sized nuts can be turned by each head.

Opening clear through head to allow passage of bolt.

Reverse action instantaneous by turning pawl.

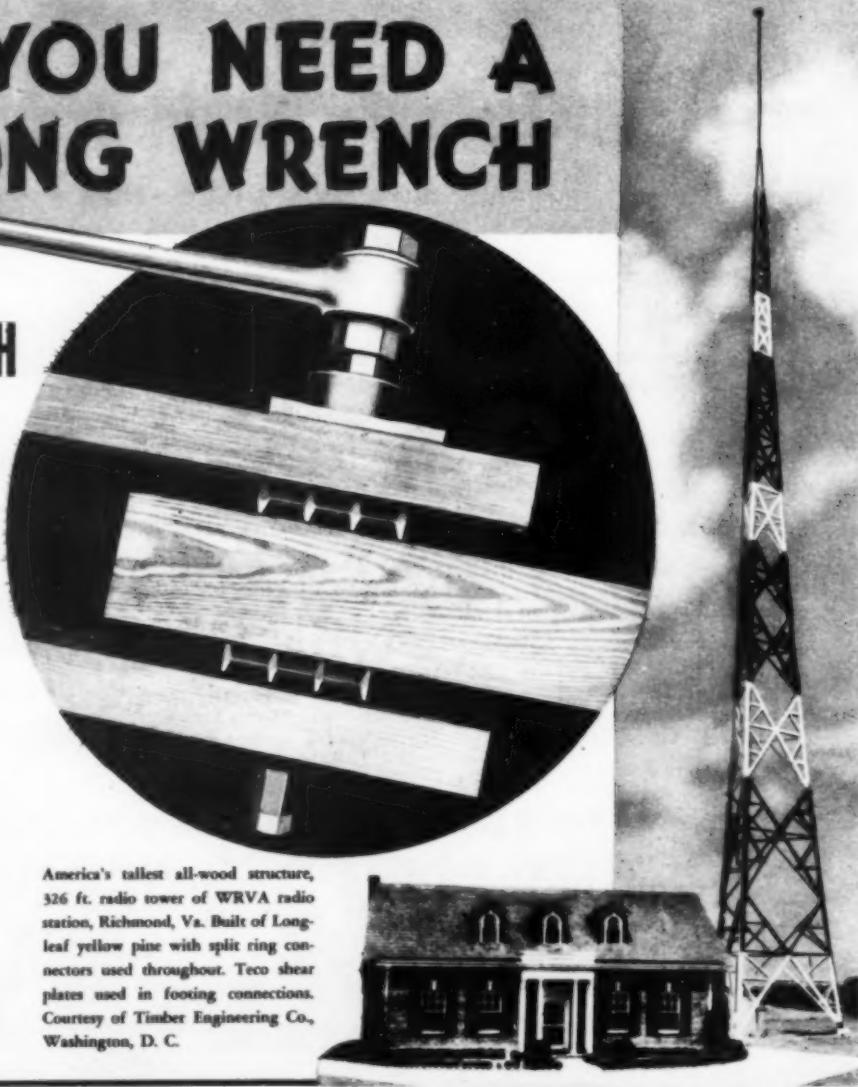
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Sole Manufacturers

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New York



America's tallest all-wood structure, 326 ft. radio tower of WRVA radio station, Richmond, Va. Built of long-leaf yellow pine with split ring connectors used throughout. Teco shear plates used in footing connections. Courtesy of Timber Engineering Co., Washington, D. C.





MERELY TILT and POUR

The Smith Tilter is the fastest discharging mixer in the industry. You merely tilt the drum and let gravity pour out the entire batch — the quickest and most practical way of emptying a mixer drum, just as it is the quickest and best way of emptying a pail of water.

Other types of mixers LIFT the material and thus use power to discharge the batch. Why not use gravity, like the big

LIKE EMPTYING A PAIL
You wouldn't think of emptying a pail with a dipper. It takes too long. The fastest, most practical way is to TILT the pail and POUR out the entire contents.

Smith Tilters have done and are doing on huge projects such as BOULDER DAM, NORRIS DAM, TYGART VALLEY RESERVOIR, FORT PECK DAM, MUSCLE SHOALS, and many others.

ORIGINATED BY SMITH 37 years ago, these dependable mixers have never been improved upon. During all these years, Smith Engineers have developed and perfected the design until today the Smith Tilter is universally accepted as the finest and most up-to-date high speed machine for producing big volumes of uniform concrete.

Sizes range from the 2½-S Mascot to the 112-S, the largest mixer in the world. Ask for literature.

THE T. L. SMITH COMPANY
2851 N. 32nd St. Milwaukee Wisconsin



THIS NEW CATALOG
is just recently off the press. It gives you a complete description of Smith 2½-S, 56-S, 84-S and 112-S Tilters. Write for your copy.

SMITH MIXERS

THE BOULDER DAM MIXERS

Paving the Way to *Lower Costs and Increased Profits*

In this 27-E Paver you get all the exclusive and experience-built RANSOME improvements and refinements that enable you to cut operating and maintenance costs to an absolute minimum.

If you are in the habit of asking yourself, "how do they do it?", over the success of your competitors — the RANSOME 27-E Paver may be the answer.

Whether you are now in the market for a paver or not — it pays to be informed on the "very latest" — write for Bulletin No. 128.

RANSOME CONCRETE MACHINERY CO.

Dunellen, New Jersey

The culmination of 87 years experience with mixers and mixing problems.

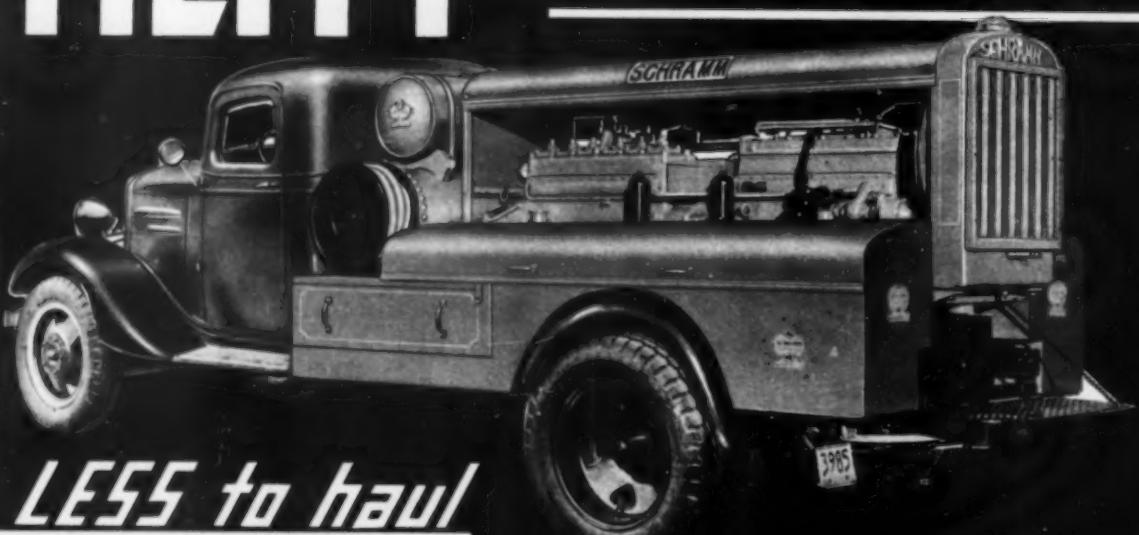
Ransome 27-E *Plus* *Built* PAVERS



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LONGER LIFE
TROUBLE-FREE
LESS MAINTENANCE
INCREASED PRODUCTION
SIMPLIFIED OPERATION
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Cost LESS to haul

Lightweight is the reason SCHRAMM "Utility" Compressors cut truck sizes in half. 50% less compressor weight. Smaller dimensions. Saves in truck cost and hauling costs. Faster travel. Bigger tool boxes. The world's most modern portable compressor.

Illustrating a Model 210 SCHRAMM "Utility" Compressor mounted on a 1 1/2-ton Chevrolet Truck. Other types of same rating require 3-ton truck. Think of the savings! Sizes: 105, 210, 315 and 420 cu. ft. actual air. Gasoline or Diesel power.

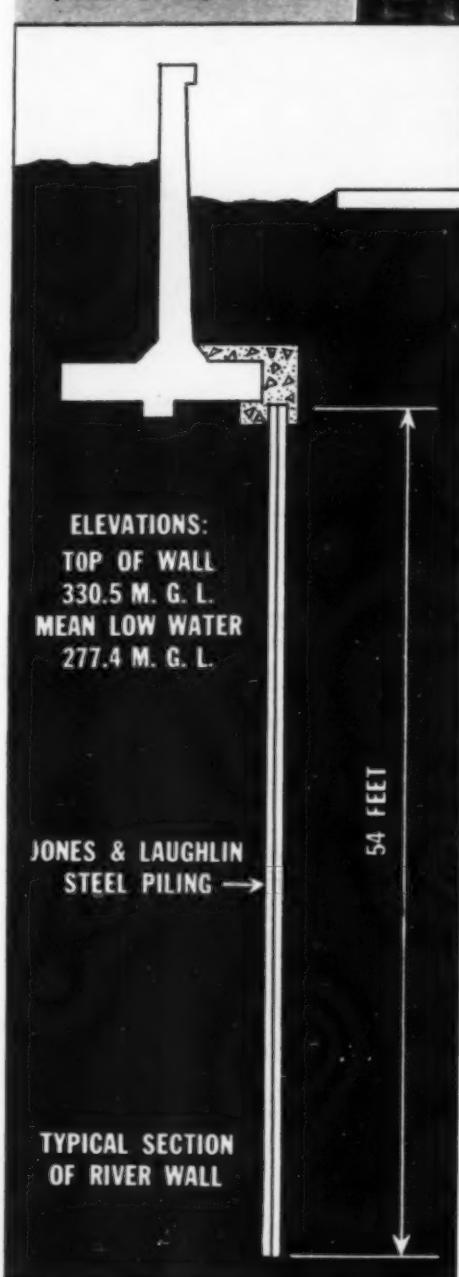
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WRITE FOR NEW LITERATURE Telling how the feature of **LIGHTWEIGHT** is accomplished in the SCHRAMM "Utility". Ask for Bulletin No. S.E. 3652

Increase your profits with

**J&L
STEEL**

Right: View showing the J&L Steel Piling cutoff wall being driven at the Cairo, Ill., flood control project. Below: A section of the concrete wall showing the position of the J&L Steel Piling cutoff wall.



CUTOFF WALL of J&L Steel Piling protects Cairo flood wall



The J&L Steel Piling cutoff wall of the Mississippi River flood control project at Cairo, Ill., permanently protects the concrete structure against undermining resulting from seepage. This was fully demonstrated in the recent flood.

The river wall at Cairo was designed and constructed under the direction of the United States Engineer's Office, Memphis, Tennessee.

J&L Steel Piling was also employed in the recently constructed flood control projects at Hickman, Ky., Caruthersville, Mo., Memphis, Tenn., West Memphis, Ark., Monroe, La., and the Bonnet Carre Spillway on the Mississippi River, 30 miles above New Orleans, La.

The Jones & Laughlin Steel Corporation maintains a special engineering staff and invites inquiries on all types of steel piling projects. All inquiries will be analyzed promptly and reported upon in detail.

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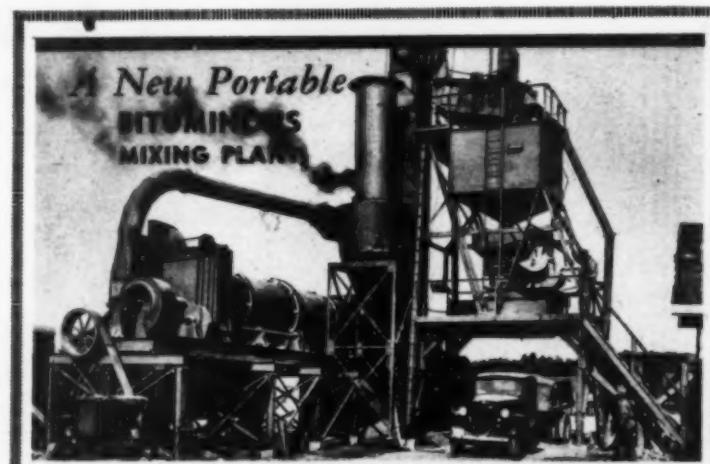
in your construction job is to cut days from your time and labor schedule; to shave many dollars from immediate as well as ultimate cost. You assure not only greater strength and dependability, but the **CORRECT** tying system for your particular problem. But it's the complimentary services which Richmond renders that makes **RICHMOND FORM-TIES** the buy for you.

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New Chevrolet trucks are now even more
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CHEVROLET MOTOR DIVISION, General Motors Sales Corporation, DETROIT, MICHIGAN

PERFECTED HYDRAULIC BRAKES (with Double-Articulated Brake Shoe Linkage). The smoothest, most efficient, and most dependable brakes ever built. • NEW HIGH-COMPRESSION VALVE-IN-HEAD ENGINE. Giving even greater pulling power—even greater economy—in an unequalled combination. • MORE LOAD SPACE—IMPROVED LOAD DISTRIBUTION. Bigger loads per trip—higher earnings per truck. • NEW STEELSTREAM STYLING. Making Chevrolet trucks for 1937 "the best-looking trucks on the road." • IMPROVED FULL-FLOATING REAR AXLE WITH NEW ONE-PIECE HOUSING (on 1½-Ton Models). Super-strong—super-sturdy—built to give many thousands of miles of dependable service.



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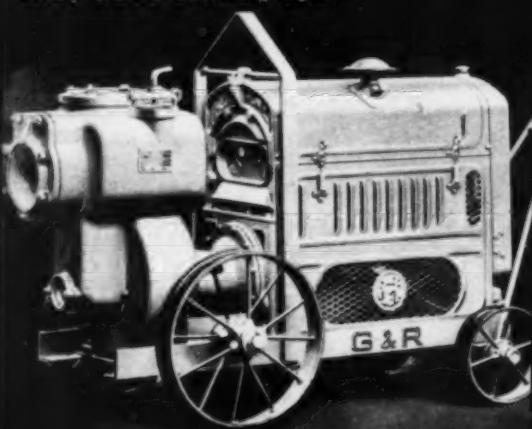
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*handle MORE water,
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See for yourself—

A G & R distributor near you is ready to give you the chance to check this pump against any job you may have coming up.



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With a Baker Bulldozer or Gradebuilder you can make your job run more smoothly. Less time out. Less repairs. The operator gets that quick, sure response to the control lever that puts the blade where he wants it when he wants it. They are built with excess strength for the tougher jobs. Yet Bakers are the most simply constructed, most easily mounted and give you the longest service. That's why there are more Bakers on more jobs.

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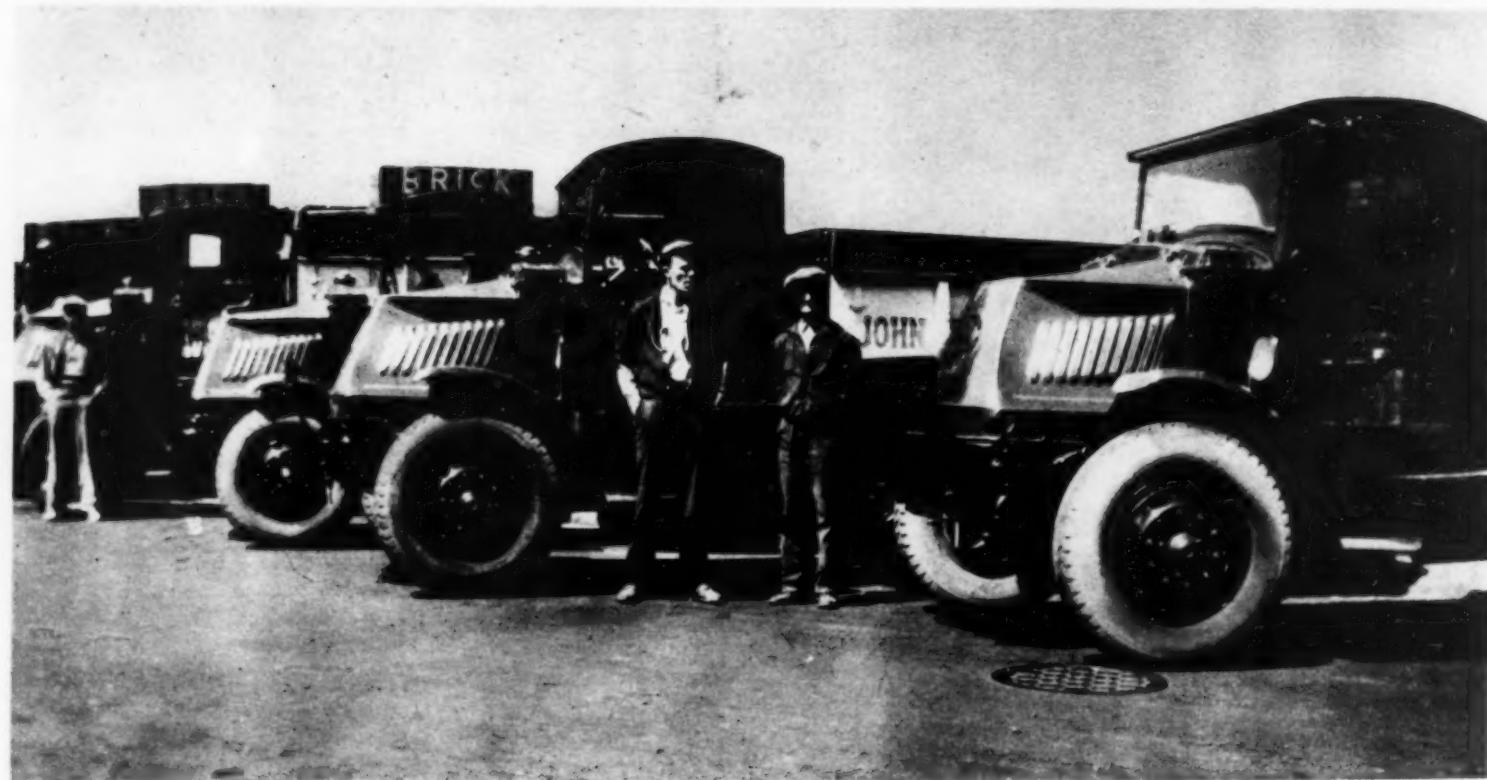


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...100% WITH DEPENDABLE GENERALS!



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Call in the General Tire dealer with his practical knowledge and experience in fitting the right type and size of tire to every kind of job. He may be able to save you money.

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- 1 Deep cut "Chevron" tread is practically slip-proof in soft going.
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- 6 Heavy dual and triple-cable beads.



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1937 The Improved Type K-10 Insley Excavator is still the first choice of shrewd contractors, because it gives the maximum in profitable shovel performance with still lower operating and maintenance costs.

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INSLEY MANUFACTURING CORP., Indianapolis, Ind.

INSLEY SHOVELS

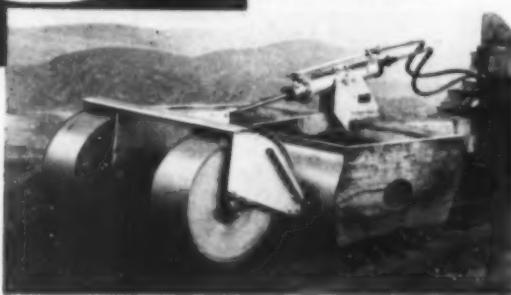
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--to make Dirt Moving Pay

BLAW-KNOX (ATECO) HYDRAULIC BOTTOMLESS SCRAPERS

The dependable performance of Blaw-Knox (Ateco) Hydraulic BOTTOMLESS SCRAPERS keeps dirt moving costs down—enables the contractor to operate his job on a definite schedule and at a profit.

It will pay you to investigate this BOTTOMLESS SCRAPER—also the Blaw-Knox (Ateco) Sheepsfoot TAMPING ROLLER.



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"SPEED EQUALS PROFIT"



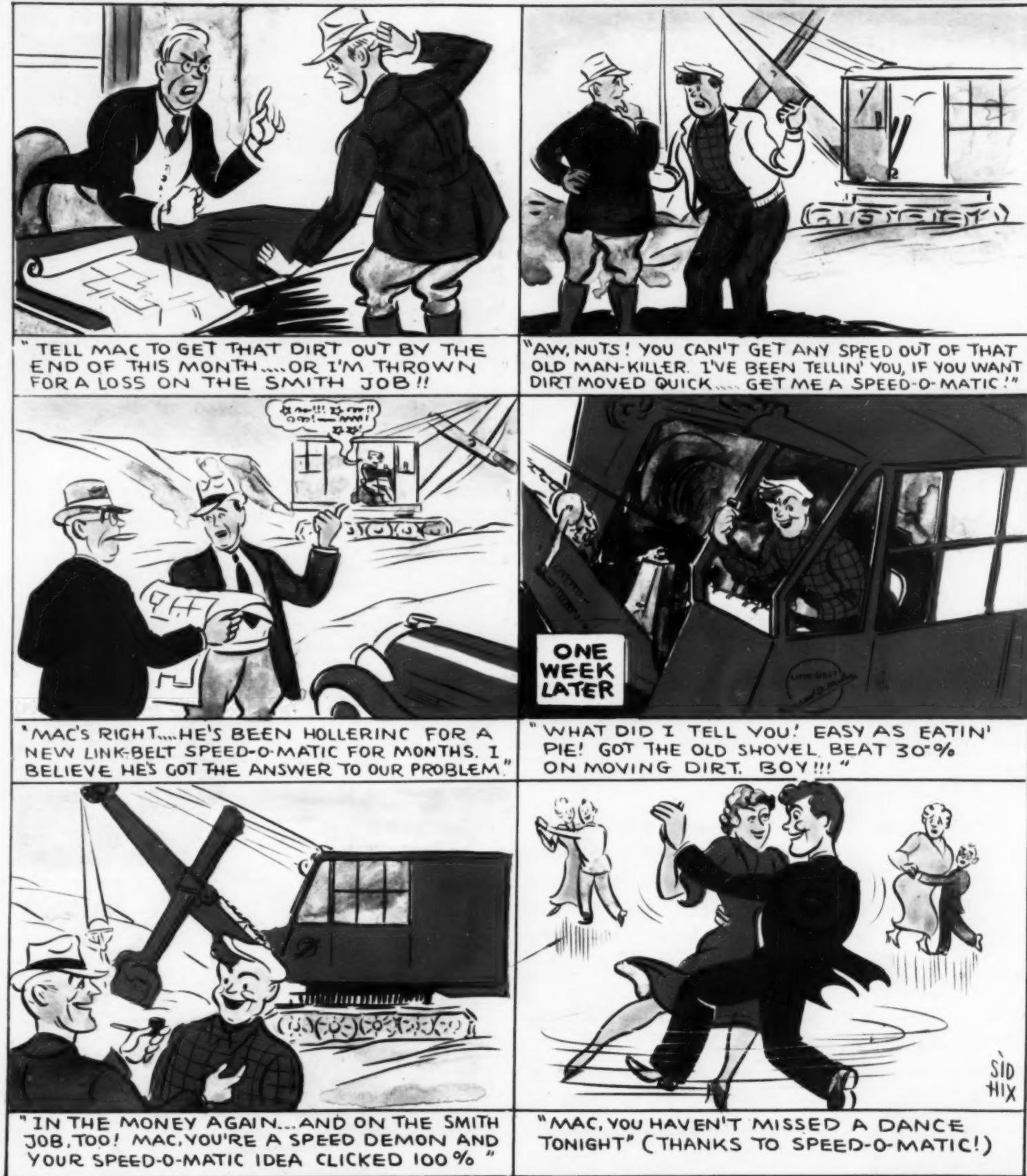
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Secure this good equipment, speed up your work, then devote your time to other details.

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SPECIFY CORDEAU for Lower Operating Costs

A large cement producer in the Middle West, the Marquette Cement Mfg. Company, specifies Cordeau-Bickford Detonating Fuse for efficient blasting. Large shots are made at the Cape Girardeau, Mo., plant, a section of which is shown in the photograph above.

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DISCHARGE
PORTABILITY
WITH STABILITY
7s — 10s — 14s

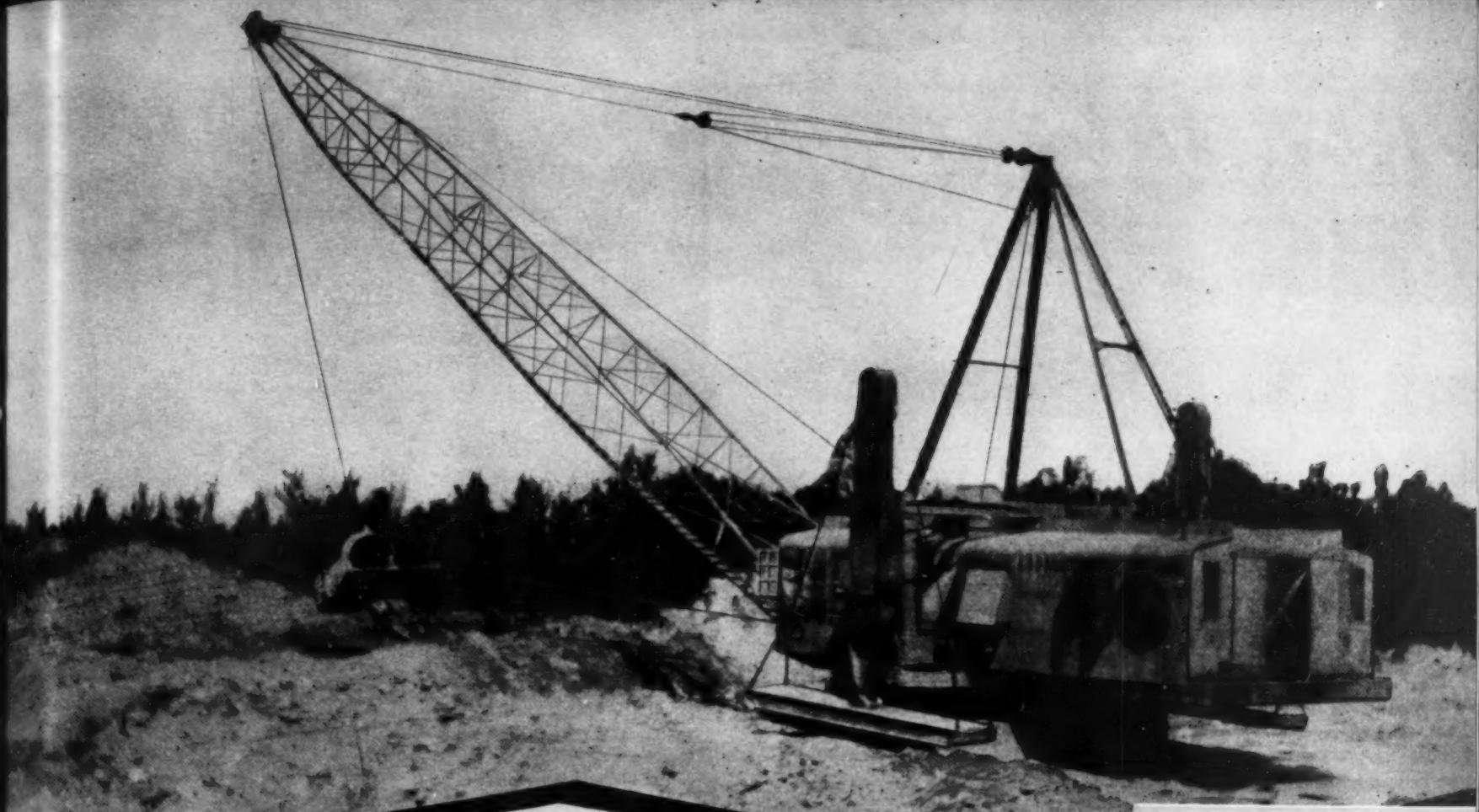
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TRAILERS
5s — 7s — 10s

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WATERLOO, IOWA

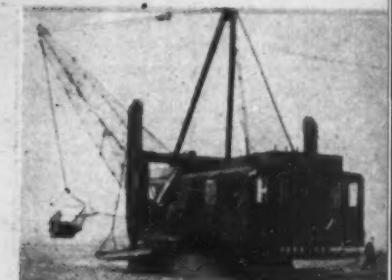


WORK and WALK this Dragline where other machines cannot go!

Because Page Walkers can *move immediately in any direction—for any distance*—they can work where other machines that travel in wide turns cannot operate.

Also — because Page Walkers *rest on a large circular base when digging*, these draglines can work on softer ground, offer greater freedom from weather conditions.

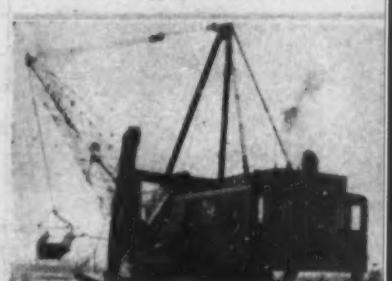
If your job requires a *high yardage, Diesel powered dragline* with complete movability under all conditions — investigate thoroughly the Page Walkers of 3 to 5 cubic yard capacity. For information write —



Machine ready to walk backward.



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Walking shoes lifting—8 foot step completed.

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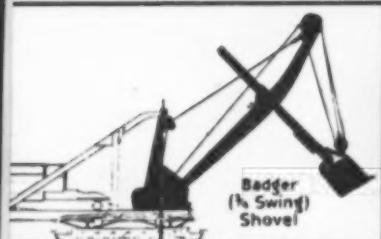
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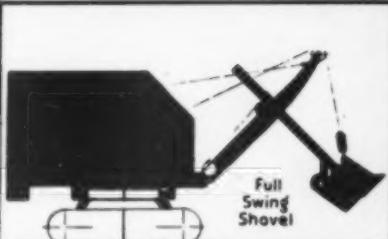
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The Three-Quarter Swing A

Will revise all your ideas of SHOVEL OUTPUT, economy and versatility



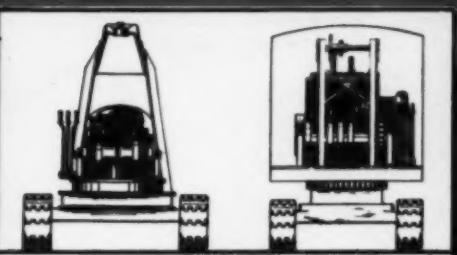
Parts shown in black indicate the great difference in the masses moved with every swing of a Badger and full revolving shovel. The heavier weight to be moved by the full swing shovel makes starting and stopping slower.



Full Swing Shovel



Black lines indicate that part of the swing used by the Badger (top) and the full revolving shovel (bottom) for starting and stopping.



The Badger's weight is near the ground . . . providing an unusually low center of gravity and stepping up digging power.

•BUILT TO OUTPERFORM•

Unhampered by the time-wasting, cost-boosting handicap of full swing, with its swinging counter-weight . . . the 3/4-swing Badger has set a new standard of shovel efficiency and economy.

The diagrams shown here show why this nimble, powerful digging unit consistently outperforms a full revolving shovel of the same rated capacity. It is obvious that quicker pick-up and quicker stop means more swings per hour. And more swings per hour means more yards per day. It's equally clear that low center of gravity means greater digging power and speed . . . that elimination of tail swing permits fast operation in tight places, impossible for a full revolving shovel. Further speed and efficiency are provided by the distinctive upward curve of the boom and the high position of the shipper shaft . . . giving extra reach . . . extra dumping height.

Mail coupon for full details on these output-increasing Badger features . . . and other outstanding advantages such as convertibility for crane, drag line, trench hoe, or pile driver.



The Austin-Western Road

RAW BADGER SHOVEL



The Austin-Western Road Machinery Co.,
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Any good workman is a better workman when he wraps his hand around a Williams' Adjustable Wrench. Well-balanced, easy-working . . . it's the strongest carbon-steel wrench of its type made today. In spite of its unusual strength it's not bulky or heavy—new design features provide extra strength with no increase in head thickness. An ideal wrench for construction work.

Also Williams' "Superjustable" Wrenches—same features, but drop-forged from Chrome-Alloy steel. Slim-jawed, light, strong—handsomely chrome-plated. Five sizes, 4 to 12".

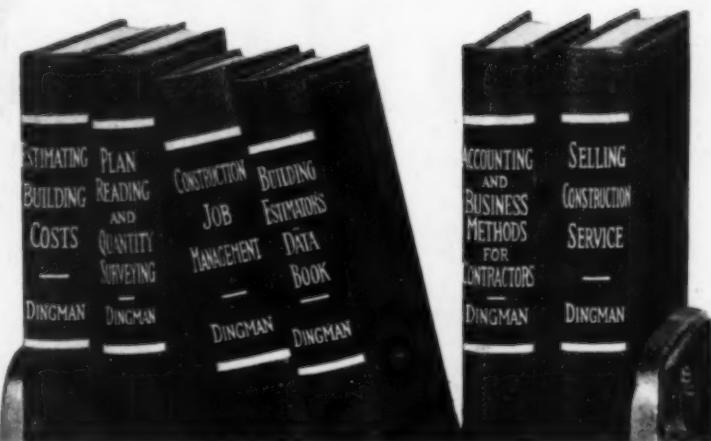
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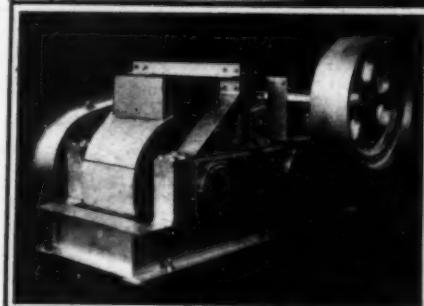
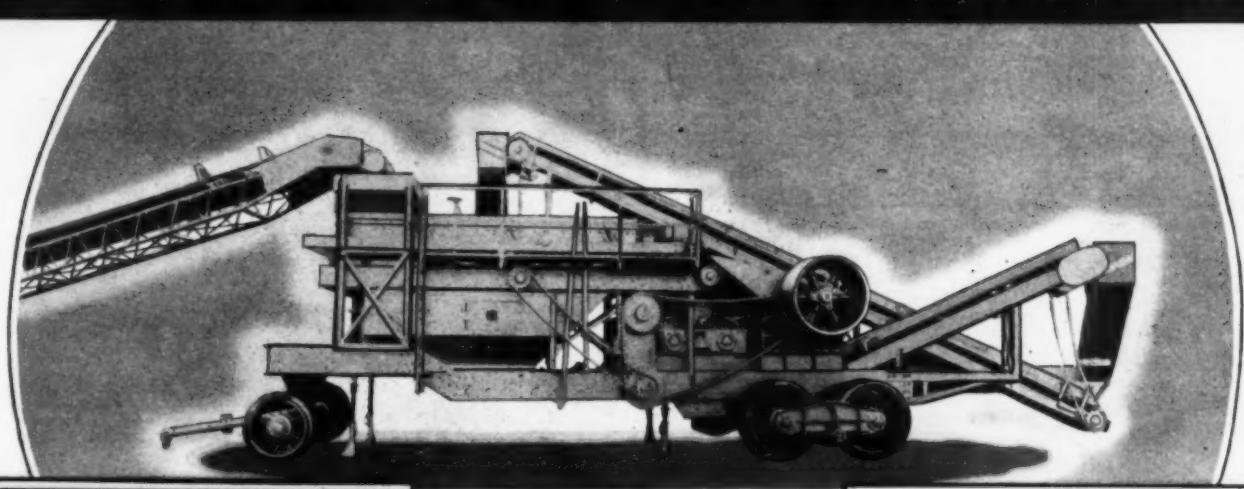
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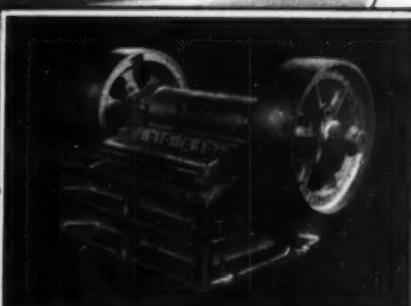
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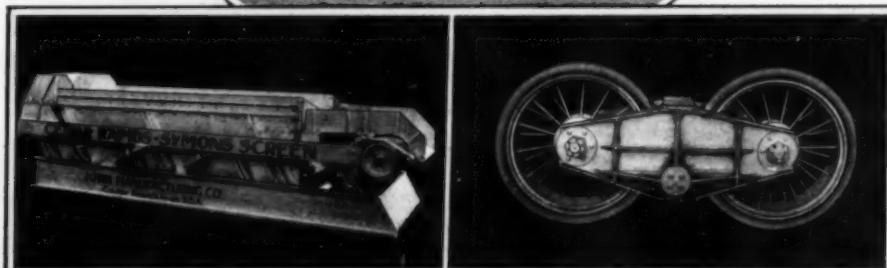


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Insure your
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Centrifugal JETTING Pump
POWERED BY FORD V-8 ENGINE**

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11-13 Southwest Blvd., KANSAS CITY, MO.**



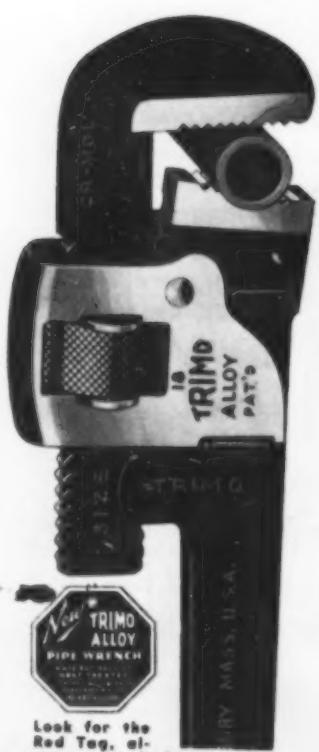
STERLING QUALITY

Ford Engine furnished with steel enclosing hood, side panels and gasoline tank.

Heavy duty pump shaft supported on two large ball bearings—chrome nickel steel impeller—hardened steel wearing rings—pressures up to 200 lbs.

Write for complete information and prices.

**DEVELOPED THROUGH 50 YEARS
TO MEAN A GREAT NAME
IN WRENCHES**



TRIMO

Made throughout of
Chrome Molybdenum
Nickel Alloy Steel—
and **DROP FORGED**.
Trimo gives a tighter
grip—a quick release.

TRIMONT MFG. CO., Inc.
Roxbury (Boston), Mass.

Look for the
Red Tag, al-
ways attached to every
Trimo. Your identification of
Trimo Quality.

Two hundred and thirty-five feet per day was the *average* progress on this sewer job. A Moretrench Wellpoint System kept the trench bone dry well in advance of the excavation. That eliminated two costly items—worry and sheeting.

Whether your job is large or small,—predrain the wet stuff with Moretrench. It pays always.

MORETRENCH CORPORATION

Sales and Rental Office: 90 West St., New York *Plant: Rockaway, N. J.*



HERE'S WHAT ONE CONTRACTOR DID...



Chrysler Press Shop—Detroit—10,300 cubic yards



General Motors Stamping Plant—Grand Rapids
24,500 cubic yards

**MODERN CONCRETE PLACING
IS CHEAPER WITH
MODERN PLACING METHODS**



Jones & Laughlin Strip Mill—Pittsburgh—37,700 cubic yards

Knowing this, J. A. Utley, Contractor and Engineer of Detroit, bought a Rex Pumpcrete three years ago—used it to place 24,500 yards for the General Motors Stamping Plant at Grand Rapids. Later he purchased another—then two more—and still another. His five Pumpcretes have now worked on jobs of 1,500 yards, up to 38,000 yards, from one end of the country to the other, placing a total of over 125,000 cubic yards of concrete. A record? Yes, it's a record; but similar records of Pumpcrete performance may be found on the account sheets of a great many of the nation's most successful contractors. They found—and you'll find—that It Pays to Forget the Old Stuff.

*Don't Bid—Don't Buy—till you investigate the up-to-date
method of placing concrete*

CHAIN BELT COMPANY, 1664 W. Bruce St., Milwaukee, Wis.

MORE OF HIS JOBS—PLACED BY PUMPCRETE

For General Motors Corporation:

General Motors Stamping Plant
Grand Rapids, Michigan
General Motors Assembly Plant
Los Angeles, California
General Motors Assembly Plant
Linden, New Jersey

For the Chrysler Corporation:

Chrysler Warehouse — Marysville,
Michigan . . . Chrysler Press Shop,
Detroit, Michigan

For the Jones & Laughlin Steel Company:
Hot Strip Mill—Pittsburgh, Pa.

For the World's Champion Detroit Tigers:
Navin Field Addition



REX UP-TO-DATE METHODS OF HANDLING CONCRETE

CONCRETE BY PIPE LINE—WITH THE REX PUMPCRETE

CHAIN BELT COMPANY of Milwaukee

GOODALL

Wet Weather Clothing Gives You the EXTRA Wear and Service that Means Real Value and ECONOMY!

BOOTS

Just the kind you need for long service and perfect comfort, no matter what sort of work you do. Hip length, $\frac{3}{4}$ length or short, in all sizes.

OILED COATS, JACKETS, OVERALLS, HATS

Quality garments, thoroughly waterproofed by a special compound that will not stick or crack. Comfortable, long-wearing; with special features you'll appreciate.

RUBBER COATS AND HATS

A complete line, for every kind of job. Noted for their durability and the maximum protection they afford.

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SAN FRANCISCO

LOS ANGELES

SEATTLE

Mills: Trenton, N. J.



GOODALL RUBBER GOODS

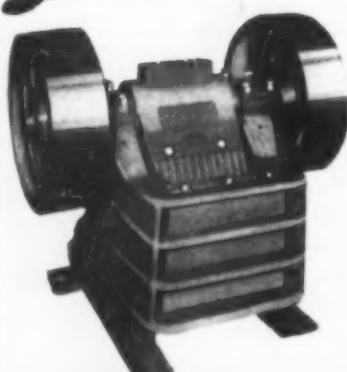
The originators of the "Standard of Quality" line (Reg. U. S. Pat. Off.) of contractor's rubber goods.

ROGERS
JOPLIN

The sign of...

Dependability

*Our users will tell you
about*



CRUSHER

sizes — 6" to 36"

In fact more Crusher for your Dollar

ROGERS IRON WORKS CO.

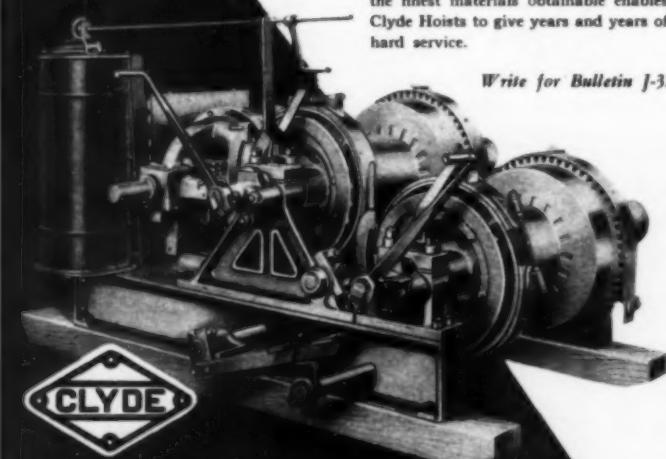
JOPLIN • MISSOURI

Clyde Hoists

Modern equipment is needed for modern conditions. Clyde electric hoists are designed and built to give the utmost satisfaction and value in the hoisting field. Quality hoists that are unexcelled for operating a derrick, concrete tower work, pile driving, steel erection . . . in fact for all kinds of general construction work.

Long wearing friction, liberal brake surfaces, extra sturdy construction and the finest materials obtainable enables Clyde Hoists to give years and years of hard service.

Write for Bulletin J-3.



Clyde Iron Works, Inc.
DULUTH - MINN.



International Trucks in line for their 8-yard loads from the shovel, while an International Diesel TracTracTor levels off the ground on the site of Baltimore's new airport.

Building the Baltimore

AIR-MINDED Baltimore . . . selected by Pan American Airways as one of the main terminals on the Atlantic seaboard for the proposed trans-Atlantic transport service . . . now anxiously awaits completion of its \$5,000,000 airport on Chesapeake Bay which will have all facilities for berthing the giants of the air, on both land and water.

Started in 1929, work was stopped when funds ran out. Last year, contracts were awarded to the Arundel Corporation to complete the project. Preliminary operations call for the placing of 3,500,000 cubic yards of dirt over the old fill made in 1929. This part of the work was sublet to E. A. Hoffmeister, one of Maryland's largest dirt contractors, with the stipulation that the fill be finished in 15 months.

"Thanks to our International Trucks and Tractors, the work will be done on time," says Paul Gera, supervisor of operations for Mr. Hoffmeister.

Thirty International Six-Wheel Trucks and two International Diesel TracTracTors (crawlers) are on the job. Twenty-four of these trucks went to work when fill-in operations started in December. Six have been added since. Their schedule calls for moving three loads, of eight cubic yards each, every hour for 20 hours every day. The excessive sponginess of the ground causes the trucks to sink down to the axles in many spots, but their ample reserve power pulls them out easily.

The TracTracTors, equipped with bulldozers, have their work cut out for them. They are kept busy leveling off the new fill and keeping the

truck roadways level.

"Our equipment is tough," says Mr. Gera. "It has to be to stand the abuse and shock on a job like this."

When the fill is finished, construction of runways, buildings, etc., will get under way. Baltimore citizens are waiting for the thrill that will come when the first trans-Atlantic flying boat settles down into this great terminal base. The men behind the scenes are getting a thrill now, watching these International Trucks and Tractors in their race against time, preparing the way for the airliners to come.

For further evidence of the ability of International Trucks and Tractors to handle your jobs, call on the nearby Company-owned branch or industrial dealer.



Powerful trucks, these International Six-Wheelers. Despite the sponginess of the ground, they pull themselves out of holes easily.

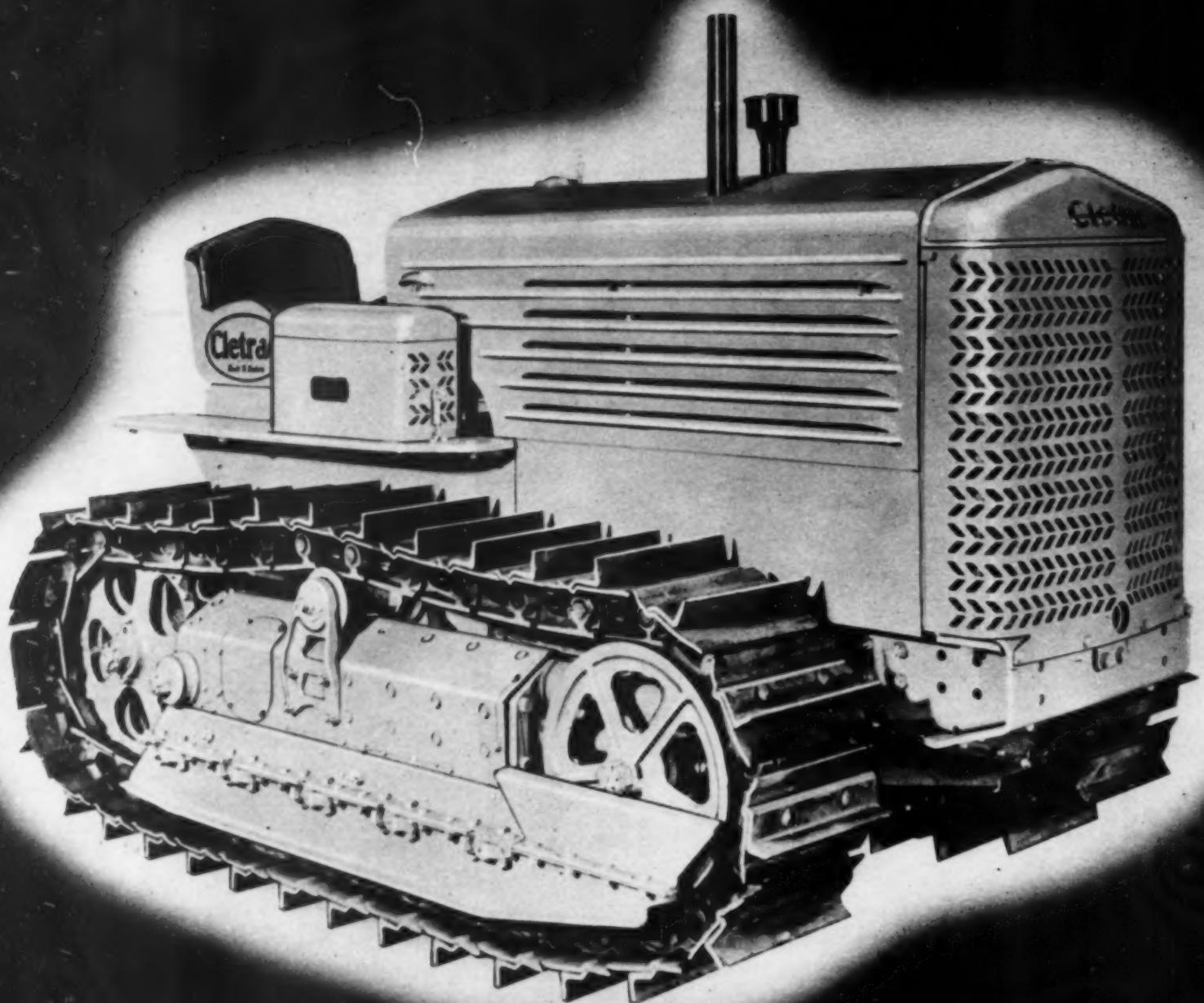
INTERNATIONAL HARVESTER COMPANY

(Incorporated)

606 So. Michigan Ave.

Chicago, Illinois

INTERNATIONAL HARVESTER



Cletrac
Crawler Tractors

Diesel, Tractor Fuel, Gasoline...Six Sizes

Built to cut costs...increase loads...fatten profits

One look at the new streamlined Cletrac Crawlers and you know that here are tractors built to give you the economy, the dependability, the PERFORMANCE you want.

Wrought steel main and side frames support the engine, transmission, and super-structure, taking all strain from engine and transmission castings.

A dead axle, forward of the rear axle, gives both proper line of draft to the drawbar and absorbs jolts and jars without their reaching the final drive.

Exclusive Cletrac differential steering keeps both tracks pulling at all times, on the turns as well as the straightaway — enables you to haul

larger loads on the turns.

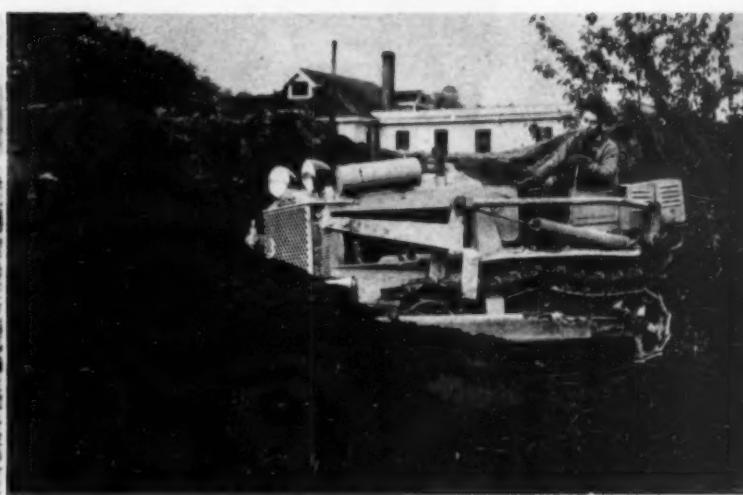
Now add Cletrac's performance on the job. Watch their "light-footedness" in getting across tough spots without miring down . . . the size of the loads they pull on the hills . . . ease of handling in tight corners . . . true-course steering — and safety — on the steepest grades.

Whatever your job — large or small — in solid rock, soft sand, sticky clay, or bottomless mud, there's a Cletrac to handle it more economically, faster, better. Six sizes and fifteen models. Diesel, Tractor Fuels, or Gasoline. (Gasoline models can be fitted with high compression heads to burn 70 octane fuel at no extra cost.) 22 to 94 horsepower.

THE CLEVELAND TRACTOR COMPANY, CLEVELAND, OHIO



Another of the big jobs done with a Cletrac. Two of nine 94 horsepower models that moved three-quarters of a million yards of dirt in the relocation of a river in Northern Ohio.



A 61 Horsepower Model DD Cletrac Diesel backfilling on a flood control job in Seattle, Washington. Working in heavy sand, this outfit is using less than two gallons of 6 cent fuel an hour.

Cletrac
Crawler Tractors
Built To Endure

The only tractors with controlled differential steering that keeps both tracks pulling at all times . . . on the turn as well as on the straightaway.

... Fifteen Models... 22. to 94. Horsepower

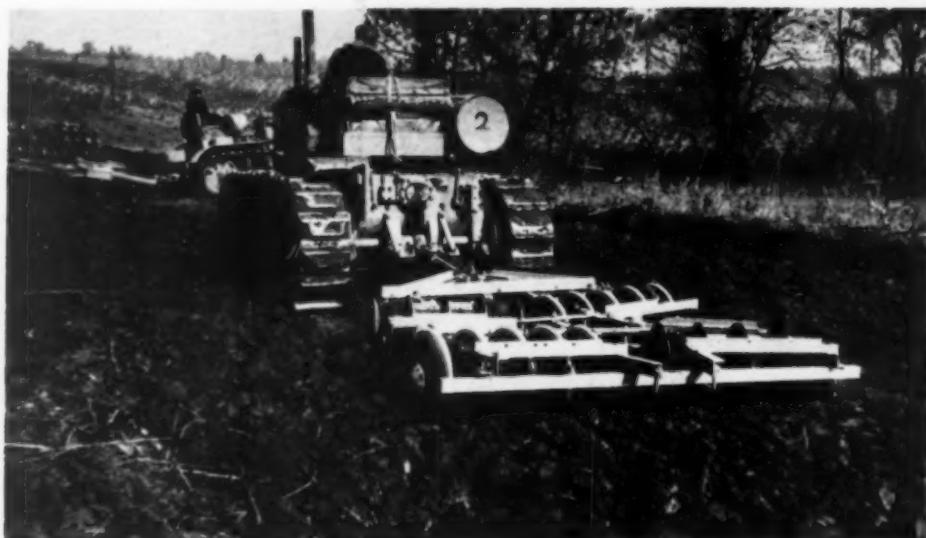
Killefer road equipment

Revolving Scrapers
Revolving Rippers
Regular Rippers
Road Discs, or Planers
Compacting Harrows
Oil-Mix Cultivators
Ditchers
Mole-Drain Machines

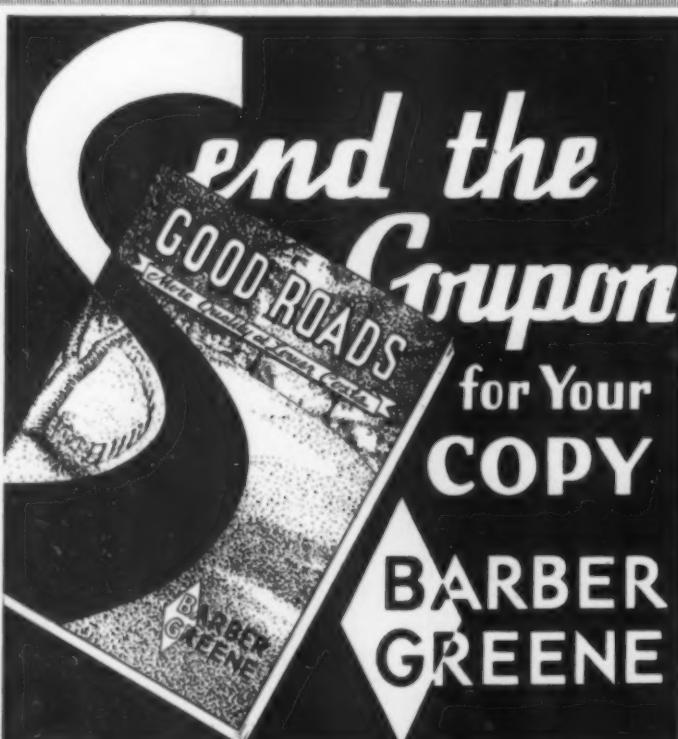
Write for Literature

THIS tandem compacting disc is a clod breaker, a smoother, a compacter and a mixer for uniform density of earth in fills, etc. Widths 5' to 10'. Weights 1100 to 2700 lb. Discs 20", 22" or 24" in diameter. Discs 6" or

9" apart. Photo shows the 8' model on highway fill near Henry, Illinois. Sold by "Caterpillar" distributors everywhere. Write for folder. Killefer Mfg. Corp. Ltd., Los Angeles, California, and Peoria, Illinois.



Road Disc Harrows



BARBER-GREENE COMPANY, AURORA, ILL.

Gentlemen:

Please send me your new 52-page booklet, "Good Roads", which shows the entire Barber-Greene line of equipment for contractors.

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Company _____
Street _____
City _____ State _____

37-4



FASTER ACTING!
Shorter cable over haul saves time between bucketfuls.

MORE POWERFUL!
Power-arm combination of lever and block-and-tackle makes it a **DIGGING DEMON**

The Williams "Champion" Power-Arm Bucket.

BUILT TO LAST! There is an extra margin of strength built into the Williams "Champion" at every point of stress and wear, to back up this bucket's greater digging power. Order a "Champion" for your next job and SEE the difference in output. Write for bulletin.

THE WELLMAN ENGINEERING CO.

7019 Central Ave., Cleveland, Ohio
Distributors in Principal Cities

WILLIAMS POWER-ARM, POWER-WHEEL
MULTIPLE-ROPE, DRAGLINE
Buckets

Take a contractor's word for it:

IF YOU CAN MAKE MONEY BUILDING BRIDGES YOU CAN MAKE MONEY BUILDING CONCRETE HOMES!

HERE is a concrete contractor who had wide experience in handling large-scale concrete construction. Last year he decided that houses offered a big opportunity for profitable sales. He built one reinforced concrete home to order; then a speculative one as a demonstrator. Now he is preparing to devote himself chiefly to concrete home construction.

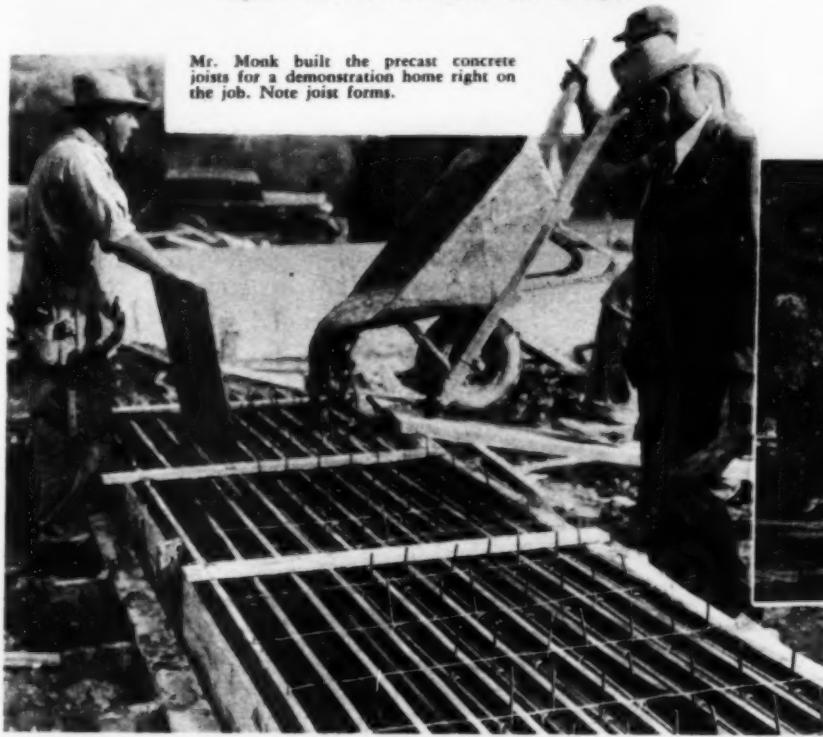
Scores of builders are working independently or making cooperative arrangements with realtors to cash in on the growing popularity of concrete home construction. Your equipment, experience and personnel qualify *you* to do the same thing — to gain the extra profit opportunities that result from building the complete resi-

dence right from the front walk back to the garage.

Properly built concrete homes are beautiful, moderate in cost, firesafe and permanent. They can be built economically one at a time or by the hundreds. Write us for the practical booklet, "Reinforced Concrete Houses — Construction Details."

PORLAND CEMENT ASSOCIATION
Dept. 4-16A, 33 W. Grand Ave., Chicago, Ill.

Mr. Monk built the precast concrete joists for a demonstration home right on the job. Note joist forms.



J. D. Monk of Austin, Texas, decided that building concrete houses was heavy-duty business in small units — and an unlimited field of opportunity.



Above — Finishing floor slab placed over precast concrete joists. Mr. Monk's house has two 3-inch reinforced concrete walls with 4-inch air space. Before the job was finished, Mr. Monk had plans for two similar homes nearby.

A monolithic concrete home at Austin, Texas, typical of the beauty obtainable with this type of construction.

**BOXOCKETS
DO IT
BETTER**

**KEEP
GOING
WITH
Snap-on Tools**

Rusted-on mud coated parts like the heavy teeth of a road scarifier — repairs and service on all types of heavy machinery — it's all in a day's work to powerful Snap-on Boxockets. Here's why:

Half the Space. Double-broached Boxocket walls give *double* the gripping points of an end wrench — require only *half the space* for full handle movement.

Greater Leverage. Boxocket handles are longer than an end wrench.

Stronger, Safer. Boxockets *completely circle the nut*, catch all six corners and *distribute* the pulling strain, combine socket wrench grip with direct leverage . . . Boxockets can't slip off the nut.

Nine Different Series in Snap-on line

Midgets to Heavy Duty sizes (3/16" to 3 1/2") — in straight offset, double offset, 15° angle and ratcheting types.

"Keep going with Snap-on Tools" . . . over 1600 in our FREE 120-page catalog. Snap-on builds a complete line of hand tools — available through its own distributing warehouses located in 37 principal cities. See Snap-on Tools in your phone directory or mail coupon below.

Snap-on Tools, Inc., Kenosha, Wis.



SNAP-ON TOOLS, Inc., Kenosha, Wis.
Without obligation Have representative call and demonstrate
 Specially interested in
 Free catalog, please

Name . . .

Firm . . .

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CM-4

C.H. & E.

PORTABLE SAW RIGS
5 sizes

**SELF-PRIMING
CENTRIFUGAL PUMPS**
9 sizes

**DIAPHRAGM, PISTON
and TRIPLEX PUMPS**
9 sizes

**SINGLE & DOUBLE
DRUM HOISTS**
10 sizes

MATERIAL ELEVATORS
MORTAR MIXERS
BAR BENDERS
BAR CUTTERS
TWO TON ROLLERS

**WRITE for our
COMPLETE CATALOG**

C.H. & E. MANUFACTURING CO.
3839 — No. Palmer St.
Milwaukee, Wis.

No. 41 Self-Priming Pump

No. 42 Self-Priming Pump

No. 48 Self-Priming Pump

Do You Know . . .

**HOW THE MODERN CONCRETE
ROAD PATCH IS MADE**

... AND WHY?



VIBRATED CONCRETE ROAD PATCHES

This is HOW . . .

Large quantities of the old, broken concrete are cemented together with some new stone and vibrated with a high-powered vibrator.

And this is WHY . . .

To make an economical all concrete patch that can be opened to the heaviest kind of traffic in **THREE HOURS!**

WRITE TO

THE INTERNATIONAL VIBRATION COMPANY
16702 Waterloo Rd. Cleveland, Ohio

GALION HAS CONTRIBUTED GENEROUSLY...

Galion has a well-earned reputation

To the many road machinery refinements that have been adopted to date, Galion has contributed generously in the last 30 years. It is this vast experience that makes Galion road building and maintenance units outstanding today.

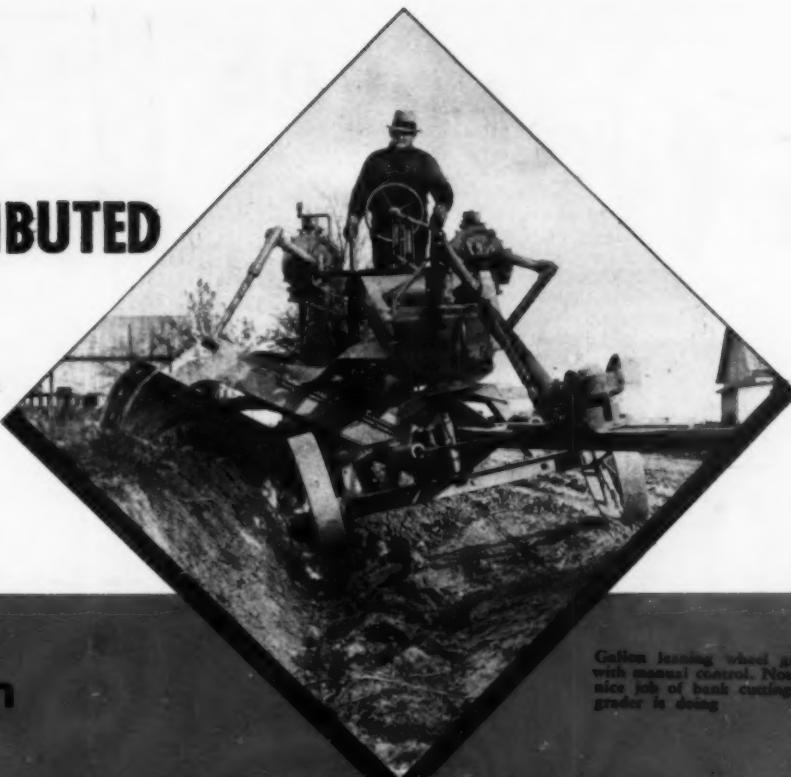
The design of the initial Galion units was guided by intimate knowledge of your requirements. Many of these early requirements have changed during the years . . . Galion has kept the faith, constantly improving and putting the 'best design' features into Galion equipment to meet the changing conditions.

Today, Galion has the most complete and most up-to-date line of road machinery ever placed into service. Each Galion unit is designed to give the maximum of ease in handling . . . flexibility in application . . . utility in use . . . minimum maintenance cost and attention.

Illustrated are some of the units in the broad Galion line. They are shown on their assigned job . . . giving their best and living up to their reputation of being capable of 'mastering' the toughest kind of blading and rolling work.

Galion maintains a corps of authorized distributors to regularly inquire, study and provide your needs. There is one in your locality whose one desire is to serve you faithfully. Ask him to tell you about the advantages of Galion Road Machinery.

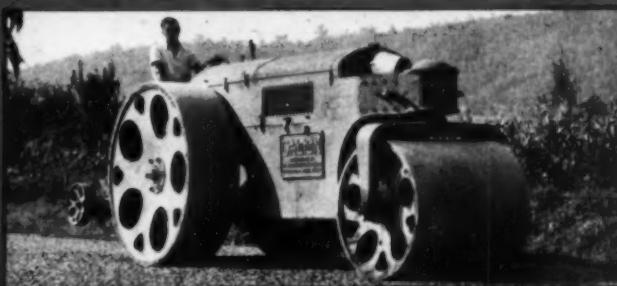
The Galion Iron Works Mfg. Co.
Galion, Ohio
NATIONAL DISTRIBUTION



Galion leaning wheel grader with manual control. Note the nice job of bank cutting this grader is doing.



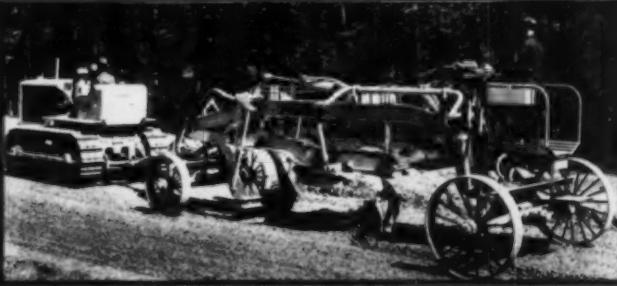
Galion 'master diesel' motor patrol grader. This unit is built to meet the requirements of the most exacting road work.



Galion 'chief' road roller. Can be furnished with diesel or gasoline power unit, and roll-a-plane attachment if desired.



Galion motor patrol grader with manual control and McCormick-Deering power unit.



Galion leaning wheel grader with hydraulic control. Also leaning wheel grader with manual control.

road rollers
motor graders
pull type
graders
scourers
drags
plow
scrapers
blades
spreader

4 features
—and every one a

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that NEW patented self-priming PUMP

FEATURES:

1. 28-foot Suction Lifts.
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3. Seepage to Full Capacity.
4. Large Air Capacities.
5. No Manually Operated Valves.
6. No By-Pass Loss of Capacity.
7. Highest Efficiency Centrifugal Pump Construction.
8. Large Clearances.
9. No Complicated Priming Mechanisms.
10. All Power Used to Pump Water.
11. No Foot Valves Necessary.
12. Extremely Rugged Pump Construction.
13. Abrasive Resisting Alloys.
14. Renewable Wear-plates.

CARTER engineers have perfected a sturdy conversion of the Ford V-8 truck engine into a power unit for HUMDINGER pumps.

This engine, acknowledged the finest engineered and constructed power at any cost, creates startling results:

- 1 — Honestly larger pump capacities.
- 2 — Fire stream pressure for jetting or water supply service.
- 3 — Enormous reserve power for long life.
- 4 — Electric self-starting equipment.

These coupled with all other HUMDINGER features, make the NEW six and eight inch outstanding units.

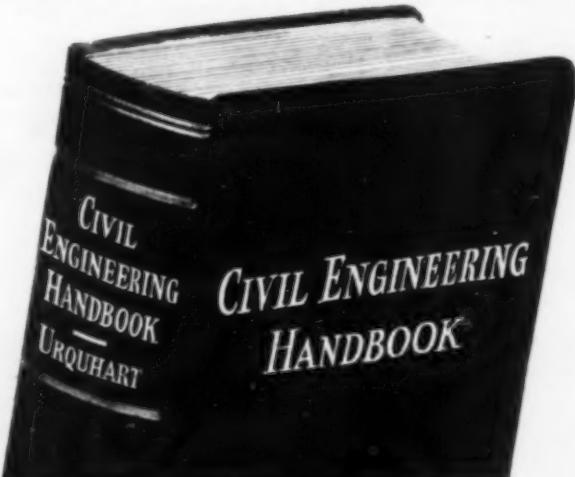
Why worry about your Dewatering Problems? Solve them with HUMDINGERS. They are manufactured in all types and sizes to meet every contracting need. Write us NOW!

RALPH B. CARTER CO.
Hackensack, N. J.

10 basic treatises

covering the entire field of civil engineering—emphasizing material needed by engineers—presenting adequate and usable treatments of essential topics.

In one new handbook at the low price of \$5.00



Urquhart's CIVIL ENGINEERING HANDBOOK

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and a Staff of Specialists

385 pages, 6 x 9, profusely illustrated, flexible, \$5.00

UP-TO-DATE, authoritative, new in approach, this book makes available to civil engineers a manual of unusual value. In one volume it presents the fundamentals of the various subdivisions of civil engineering, for the use of practicing engineers, especially when confronted with problems outside their specialized fields. In each division a noteworthy specialist has contributed a compact treatise, developing fundamental theories as well as stating more involved ones, making the book not only a comprehensive reference work, but also adaptable for systematic study of any of the fields represented in it.

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BUCYRUS - ERIE



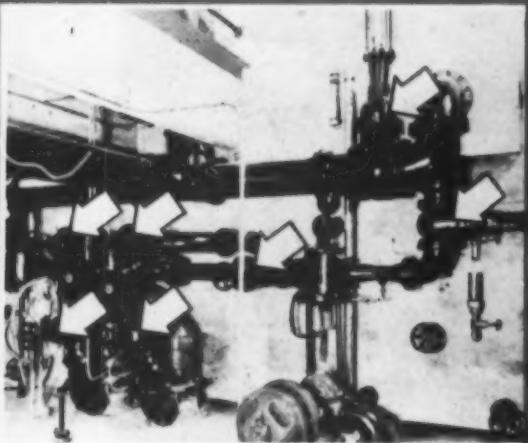
*I*n tough digging, as encountered in building this road near Hagerstown, Maryland, the Roberts Paving Company uses the famous Bucyrus-Erie 43-B. The ease with which the 43-B travels over any kind of grades, the dependability of its digging and moving brakes, and other up-to-the-minute features, give the modern contractor a machine which is big enough for large output, and yet fast enough for the widest possible work range. Send for complete details on the 43-B today!

**BUCYRUS
ERIE**

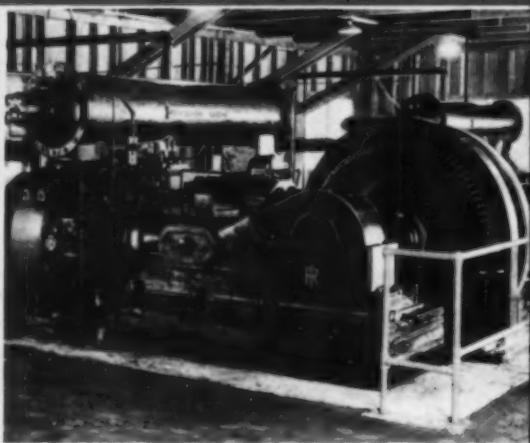
EXCAVATING, DRILLING, AND MATERIAL HANDLING
EQUIPMENT... SOUTH MILWAUKEE, WISCONSIN, U.S.A.

Tarmac Surface Treatments Make Tightly-Sealed Surfaces without Sacrifice of Skid-Resistance—Probably the most pronounced recent development in standard types of tar road construction is the change from open to tight, closed surfaces, which are better able to withstand present-day traffic requirements. Tar grades and the gradation of various sizes of aggregates have been standardized, and improved construction methods assure tightly sealed surfaces.

Even a tightly-sealed Tarmac surface is granular and skid-resistant in wet or dry weather. For safety on tight surfaces, specify Tarmac.



Western Gas (Koppers Division) Produced the Valves Used in the New Des Plaines, Ill. Waterworks—This photograph shows one of the batteries of "Western" Valves in this new municipal plant. These valves are of various sizes, ranging from four inches to 16 inches. "Western" Valves have a great advantage because the discs are suspended at their centers, which permits free rotation in opening and closing and eliminates the need for rollers, scrapers and tracks when valves are installed horizontally.



American Hammered Piston Rings Are Used in These Compressors at the Grand Coulee Dam—American Hammered Piston Ring Division of Koppers Company at Baltimore makes bronze and cast iron piston rings which are used in hundreds of ways in the public works field . . . for all kinds of automotive equipment, for Diesel engines, in pumping stations and other types of publicly-owned projects. There is an American Hammered Piston Ring for every type and size of gasoline, Diesel and steam engine.



Koppers Divisions, Subsidiaries and Affiliates Serving the Public Works Field

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THE WOOD PRESERVING CORPORATION	PITTSBURGH, PA.
NATIONAL LUMBER & CREOSOTING COMPANY	TEXARKANA, ARK.
WESTERN GAS DIVISION	FORT WAYNE, IND.
BARTLETT HAYWARD DIVISION	BALTIMORE, MD.
HILER ENGINEERING AND CONSTRUCTION COMPANY, INC.	PITTSBURGH, PA.
AMERICAN HAMMERED PISTON RING DIVISION	BALTIMORE, MD.
THE KOPPERS COAL COMPANY	PITTSBURGH, PA.
NEW ENGLAND COAL & COKE COMPANY	BOSTON, MASS.
THE MARYLAND DRYDOCK COMPANY	BALTIMORE, MD.
THE WHITE TAR COMPANY OF NEW JERSEY, INC.	KEARNY, N. J.
KOPPERS RHEOLAVEUR COMPANY	PITTSBURGH, PA.

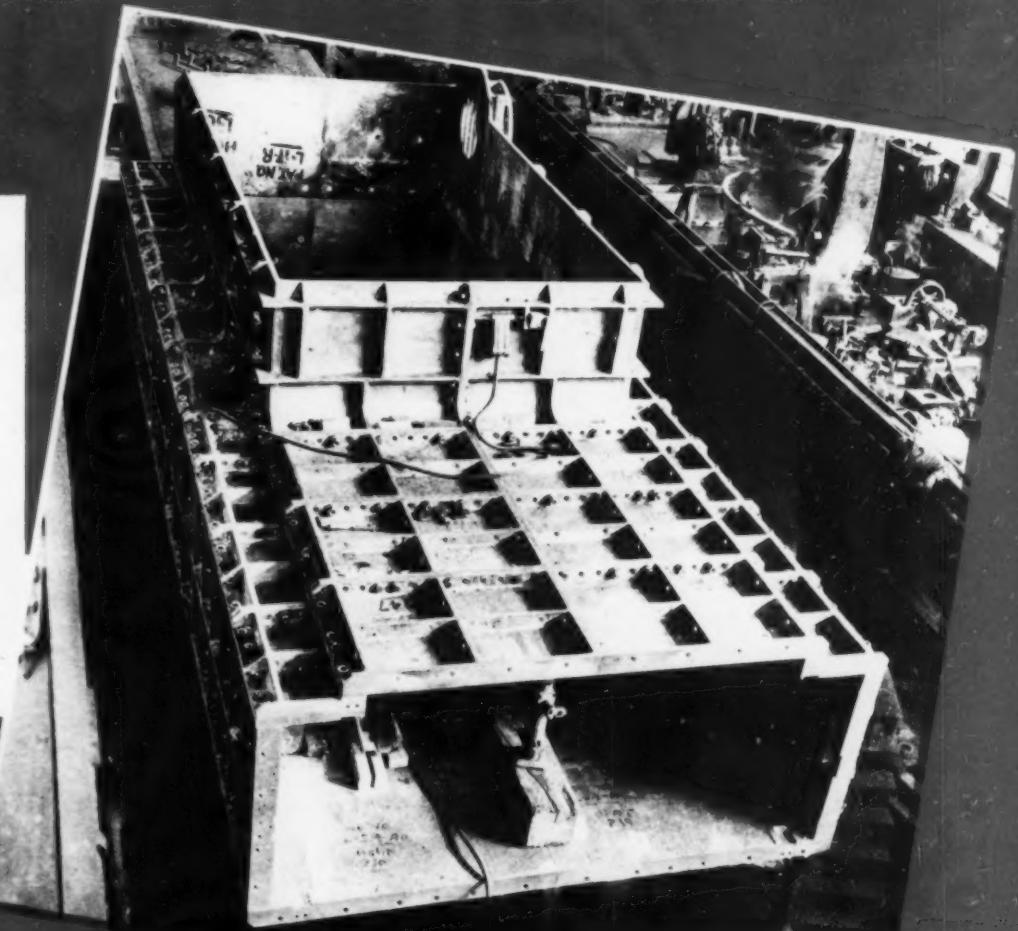
KOPPERS COMPANY...DESIGNERS...BUILDERS...PRODUCERS...MANUFACTURERS...DISTRIBUTORS

KOPPERS

serves the public works field

New Bronze (Developed by Bartlett Hayward Division) Gives Greater Strength, Ductility and Hardness Than Ever Possible Before in Non-Ferrous Alloy, and Opens Way to Many Uses—

Bronze is taking a place of greater importance among metals as a result of the development of D-H-S Bronze. This bronze establishes new records for compressive strength; it is non-magnetic, resists erosive action of water, has low coefficient of friction with steel; has excellent resistance to corrosive action by acids, salt water and the elements; is readily machinable; takes on a high polish and is not brittle. This photograph shows 69 separate gate seat and liner castings of D-H-S Bronze and B. H. Manganese Bronze, for use in the emergency gates of the Fort Peck Dam. There are eight of these in a contract exceeding \$1,000,000.00.



These Pressure-Treated Guard Rail Posts Are Safe from Decay—They were treated with salt preservatives by The Wood Preserving Corporation. This division also supplies posts, poles, guard rails, and other timber for highway work, pressure-treated with creosote and other preservatives.



This Is One More Reason Why Your Koppers Roof Will Last Longer—On every Koppers Roof, the top pouring of roofing pitch is extra-heavy . . . 70 pounds of coal tar pitch for every 100 square feet of roof surface. Let us send you the Koppers Roofing Book which tells you the OTHER reasons why Koppers roofs last so long.



This Is the Largest Known Single Shipment of Rolling Mill Bronze Castings—This group of D-H-S No. 2 Bronze castings for worm gear rims, screw boxes, housing nuts, pressure blocks, slippers and segments was produced by the Bartlett Hayward Division of Koppers for the United Engineering and Foundry Co. and E. W. Bliss Company. The unprecedented combination of strength, ductility and hardness of this new bronze is described under the photo of the Fort Peck Dam castings.

KOPPERS COMPANY, Pittsburgh, Pa.

Please send me information on:

- Castings, Koppers
D-H-S Bronze
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- Coal
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- Coal Tar Roofing
- Creosote
- Dampproofing
- Disinfectants
- Insecticides
- Fast's Couplings
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- Piston Rings
- Sewage Disposal Equipment
- Signal Buoys

- Sluice Gates
- Tanks
- Tarmac Road Tars
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- Waterworks Gate Valves
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"Upside-Down" Method
of Orderly Demolition*

HYDRAULIC BORING MACHINE
Installs Telephone Conduits Under
Main-Line Tracks of Railroad

*Portable Repair Units Cut Costs of
Asphalt Cold Patches*

PUMPED CONCRETE
Cuts Cost of Floors and Roof of
Five-Story Albany Post Office

A THIRTY ACTIVITY

STIFF-LEG DERRICKS

Handle Materials for

*How to Increase Efficiency at the
BATCHING PLANT*

From a report by
ANDREW P. ANDERSON
Highway Engineer,
Division of Research

*Planning and Planting
Medium-Sized Jobs*

By J. B. BURGHARDT,
Formerly Construction Superintendent for
J. B. Hampton & Co., Inc.



HOW

...
The reading pages show
you "HOW"—

The advertising pages
show you "WHAT
WITH"—

— a service combination
hard to beat.

...
See page 3 for "HOW"
items in the editorial
pages.

See pages 123 and 124 for
"WHAT WITH" items
made by manufacturers
whose advertisements ap-
pear in this issue.

If you do not find what
you are looking for —

Write

Construction
Methods and Equipment

Information Bureau
330 West 42nd St., New York City

April, 1937 — CONSTRUCTION Methods and Equipment



"I'm building a theatre in Hawaii, Lad.—How am I going to resist the hula stresses?"

"Take a tip from this coal tipple! 'Fleetweld' is the answer, Pop!"

"Whether you're designing to resist hula dancers, shaker screens or earthquakes, the logical plan is to provide welded joints . . . and to weld them with that strongman of welding electrodes—'Fleetweld' himself. "This 50-ton coal tipple structure is a good example. It carries four heavy-duty vibrating screens. You know what that means. Shake! Shake! Shake! Day and night. Year in and year out.

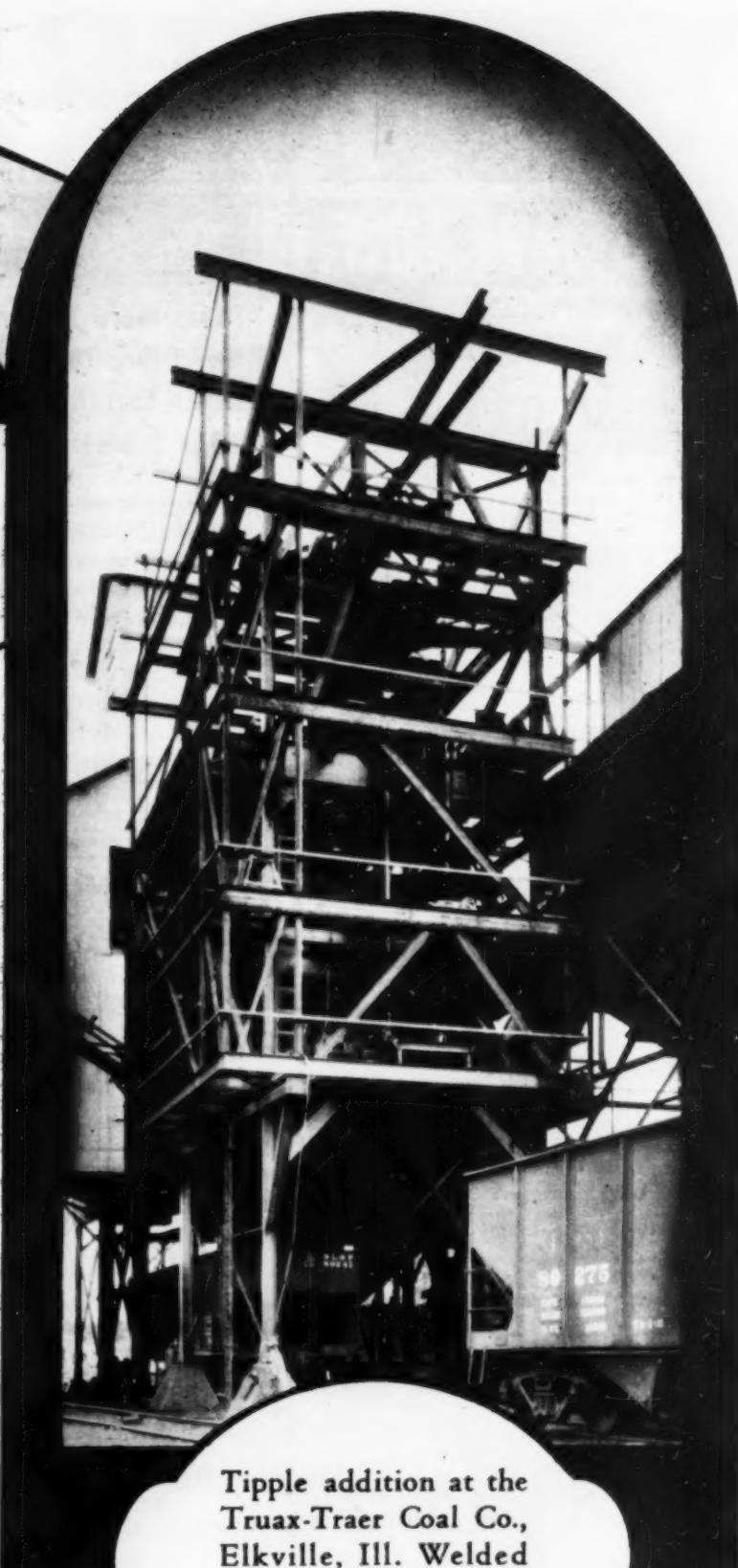
"In order to have a structure whose joints would be *permanently* tight—a solid, rigid job for all time to come—they welded it entirely. You can't beat a welded joint for fatigue strength and rigidity.

"All steel was delivered direct from the mill . . . flame-cut, fabricated and erected right on the building site, without detailed plans. This saved time and resulted in a lower construction cost.

"That's one case. Lincoln can tell you other ways to shake off difficulties and put your thinking on a firm foundation."

LARGEST MANUFACTURERS OF ARC
WELDING EQUIPMENT IN THE WORLD

LINCOLN



Tipple addition at the
Truax-Traer Coal Co.,
Elkville, Ill. Welded
entirely with Lincoln
"Fleetweld" electrode.

THE LINCOLN ELECTRIC CO.
Dept. G-367, Cleveland, Ohio.

Send me "Studies in Structural Welding" as
it is issued periodically.

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Position _____

Company _____

Address _____

City _____ State _____

QUINN PIPE FORMS

HAND or WET PROCESS

Make concrete pipe on the job with Quinn Pipe Forms. Produce uniform concrete pipe of highest quality.

HEAVY DUTY CONCRETE PIPE FORMS

Built to give more years of service—sizes for any diameter pipe from 12 to 84 inches—tongue and groove or bell end pipe—any length.

NEW MEDIUM DUTY CONCRETE PIPE FORMS

Meet the demand for low cost equipment that produces a uniform quality of pipe in smaller amounts. Same sizes as "Heavy Duty," from 12 to 84 inches—any length.

WRITE TODAY
For prices and features of Quinn Pipe Forms. Give us size of job for estimate on your pipe form needs. Also manufacturers of concrete pipe machines for making pipe by machine process.

QUINN WIRE & IRON WORKS
1625 TWELFTH ST. BOONE, IOWA

SpeedWay
Electric Hammers

Saves More Than Any Other Tool GUARANTEES Your Profit

No. 6 Electric Hammer

Through stone, concrete, plaster, brick — nothing stands in the way of a Speed-Way Electric Hammer. 1,800 powerful blows per minute. Takes drills to 1 1/4" diameter. Handy —wt. 26 lb. Built for 20-year service. It's a money-maker — makes 1 man equal to 10. Always the standard — there are more Speed-Ways in use than any others.

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1862 So. 52nd Ave. Cicero, Ill.

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Distributors in **70** Principal Cities

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725 East 140th St. New York, N.Y.

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Write for Circular on types, sizes and prices

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3856 CONTRACTORS USE "Anchor Puller-jacks

\$29.00 complete as shown

15 FT. LOAD CHAIN
SWIVEL
"ANCHOR" PULLER-JACK TYPE B
3 FT. TAIL CHAIN
RELEASE LOCK

THERE MUST BE GOOD REASONS 3856 MEN CAN'T BE WRONG
Comes in handy on dozens of odd jobs. Capacity 3 tons single line; 5 tons two-line. Sheave block \$4.00 extra if desired.

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Reynoldsville, Penna.

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WILL DRY UP ANY EXCAVATION

Faster—More Economically
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STRAIGHT EDGES — Aluminum or Steel • EDGERS — Stamped or Cast Iron • HAND FLOATS — Standard or Special • BULL FLOATS and HAND SCREEDS • CONCRETE BROOMS of Bass or Bassine.

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STEAM — ELECTRIC — GASOLINE
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New Advertisements
must be received by the 20th of the month to appear in the issue out the following month.

*Address copy to the Departmental Advertising Staff
CONSTRUCTION Methods and Equipment
330 West 42d St., New York City*

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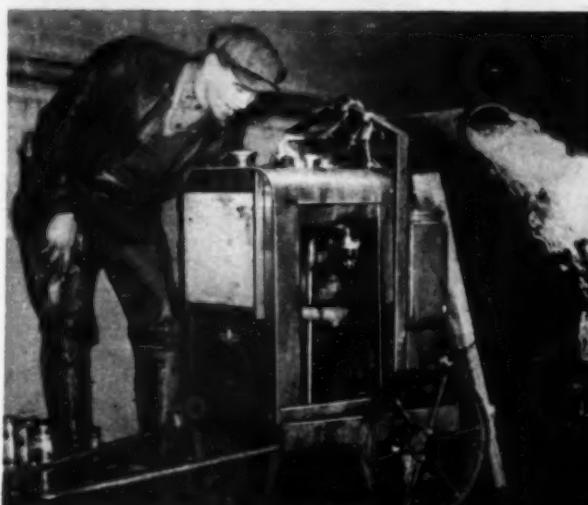
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Owen Buckets

for DIGGING • for RE-HANDLING • for SPECIAL USES •

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Handled by Hundreds of NOVO PUMPS

Rushed to the flood area—hundreds of Novo Pumps rendered faithful service in that gigantic test of men and machines. Pumping constantly, day and night, right through the disaster, and the clean up period—the pumps that stood the test.

DID YOU KNOW?

That Novo Self Priming Centrifugal Pumps now have:

GREATER HORSEPOWER than ever before?

NEW COMPACT ACCESSIBLE design?

PNEUMATIC roller bearing wheels at new low prices?

A BRAND NEW COLOR SCHEME, bright orange and black.

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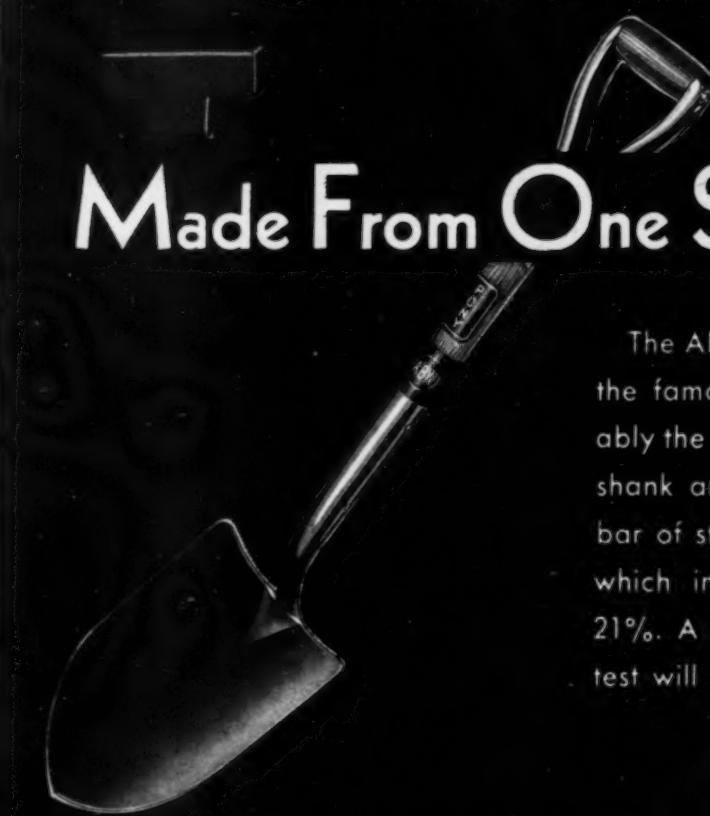


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214 Porter Street, Lansing, Michigan
Send full details on the new Novo Self
Priming Pump.

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Address _____

Made From One Solid Bar of Steel



The ABW Solid Shank Shovel equipped with the famous ABW Shock Band is unquestionably the strongest shovel on the market. Blade, shank and socket are forged from one solid bar of steel. Added to this is the Shock Band which increases the handle strength about 21%. A tough shovel for a tough job—any test will convince you.

ASK YOUR JOBBER

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O. AMES
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PONY
BALDWIN
KNOX-ALL
BRONCO
MONONGAH
HUSKY
PEERLESS
3-STAR
PINNACLE
2-STAR

SINCE
1774

AMES BALDWIN WYOMING Co.
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NORTH EASTON, MASS.

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That's what contractors are saying who know by experience. And why not . . . Heltzel templates are removable without disturbing side rails. Alignment is controlled by adjustable lateral braces insuring perfect alignment, cutting the cost of form setting at least 20% under that of any other forms made.

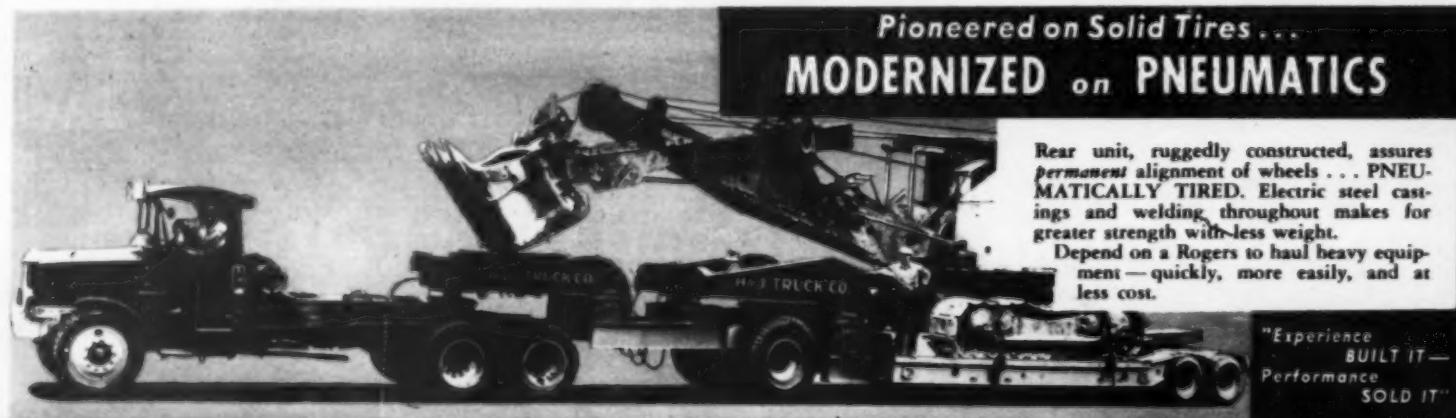
3" side reinforcing flanges make them 50% more rigid than any Gutter and Curb forms we have ever used. Standardize on Heltzel Forms . . . know your costs . . . make money on every job.

WE ARE REALLY MAKING MONEY SINCE WE REPLACED EVERY FORM WITH **HELTZEL CURB, GUTTER AND SIDEWALK FORMS.**



THE HELTZEL STEEL FORM & IRON CO., WARREN, OHIO

Pioneered on Solid Tires . . .
MODERNIZED on PNEUMATICS



Rear unit, ruggedly constructed, assures permanent alignment of wheels . . . PNEUMATICALLY TIRED. Electric steel castings and welding throughout makes for greater strength with less weight. Depend on a Rogers to haul heavy equipment—quickly, more easily, and at less cost.

"Experience BUILT IT—
Performance SOLD IT"

ROGERS BROTHERS CORPORATION . . . ALBION, PA.

"HEY...Why be a Borrow-Buzzard?"



THIS COUPON SAVES THE BOTHER OF BORROWING—AND BRINGS YOU YOUR OWN COPY OF CONSTRUCTION METHODS EACH MONTH—with a host of new features you'll want to keep for reference

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IT'S "IDEA INSURANCE"

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An index of products made by manufacturers whose advertisements appear in this issue of CONSTRUCTION Methods and Equipment.

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Barber-Greene Co.

ASPHALT

Texas Company

ASPHALT PLANTS

Blaw-Knox Company

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Link Belt Co.

Northwest Engineering Co.

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Jones & Laughlin Steel Corp.

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Heltzel Steel Form & Iron Co.

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Goodall Rubber Co.

Goodyear Tire & Rubber Co.

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Chain Belt Company

Heltzel Steel Form & Iron Co.

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Ensign-Bickford Co.

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International Nickel Co., Inc., The

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Automatic Nut Co., Inc.

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Goodall Rubber Co.

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La Plant Choate Mfg. Co.

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Roebling Son's Co., J. A.

CABLEWAYS

Roebling Son's Co., J. A.

CARBIDE

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Portland Cement Ass'n.

Universal Atlas Cement Co.

(U. S. Steel Corp. Subsidiary)

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330 West 42nd St.

New York City

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Novo Engine Co.
Sterling Machinery Corp.

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Sterling Machinery Corp.

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TAR
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WELDING GAS
Linde Air Products Company, The

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Roebling Son's Co., J. A.
Wickwire Spencer Steel Co.

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Moretrench Corp.

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WIRE ROPE ACCESSORIES
Hazard Wire Rope Co.
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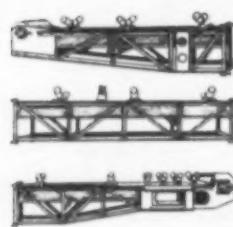
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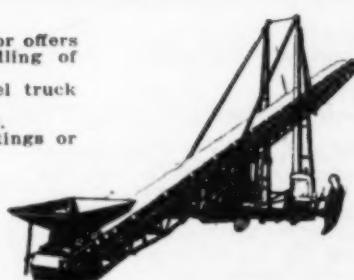
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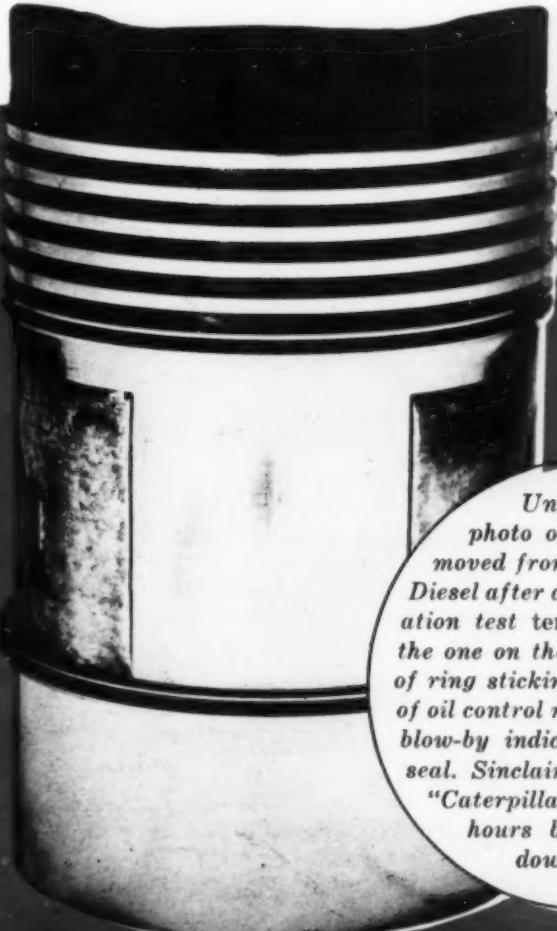
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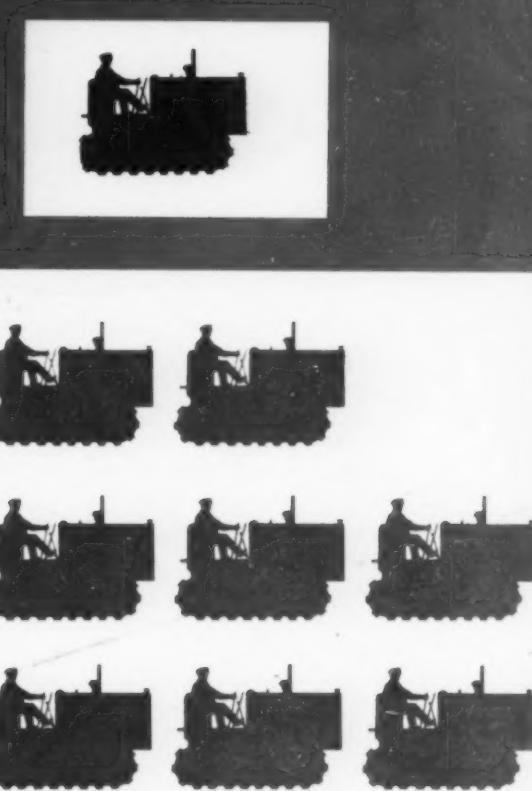
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Unre touched photo of piston removed from a "Caterpillar" Diesel after an accelerated operation test with finest straight mineral oil. Note carbon-coated piston crown, sludge, plugged oil control rings and gum on piston skirt, and evidence of excessive blow-by, resulting from poor piston seal.



Unre touched photo of a piston removed from a "Caterpillar" Diesel after an accelerated operation test ten times as long as the one on the left. Note absence of ring sticking, perfect condition of oil control rings. Freedom from blow-by indicates proper piston seal. Sinclair Ten-ol multiplies "Caterpillar" Diesel service hours between shutdowns by ten.



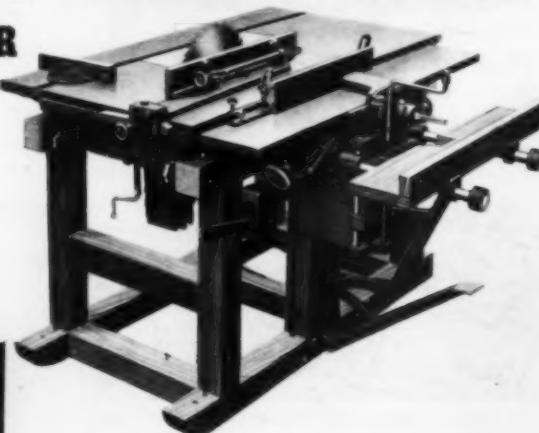
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